Manufacturing Chemist

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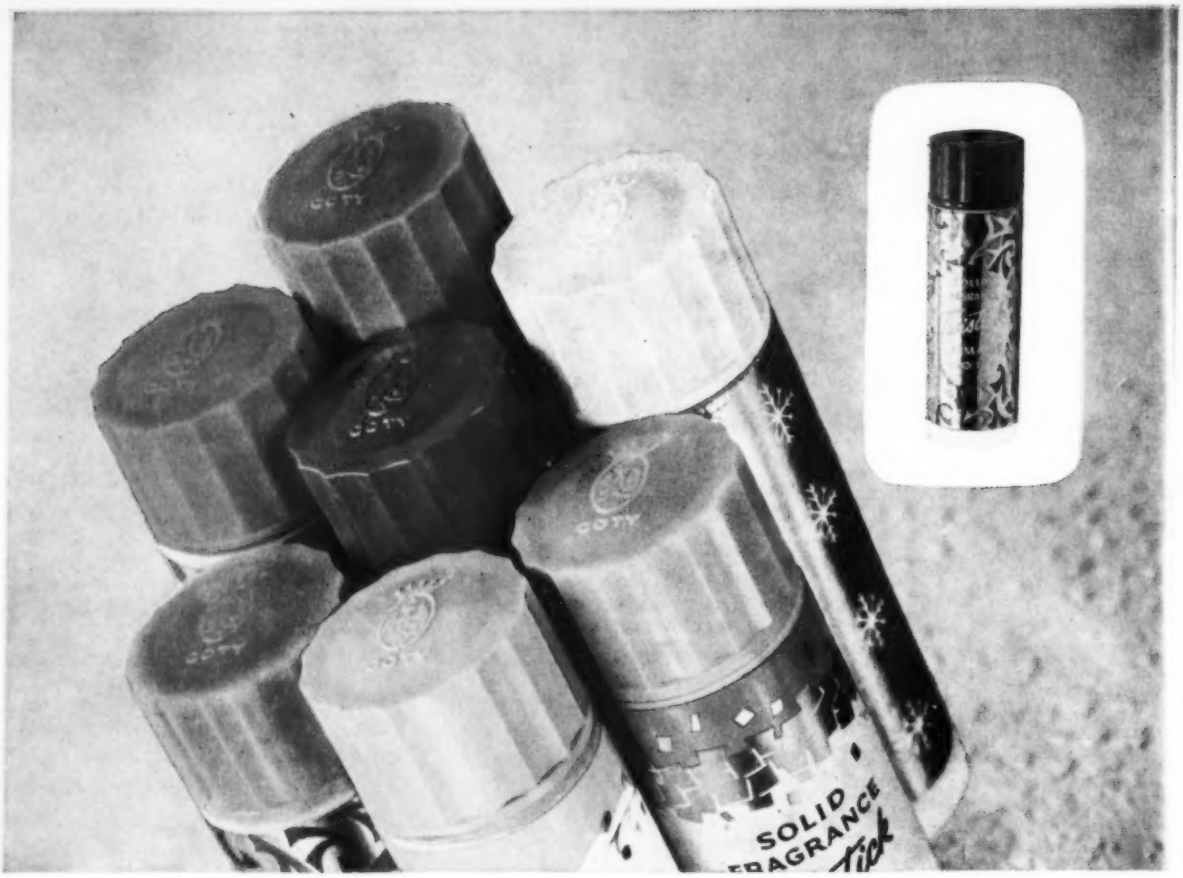
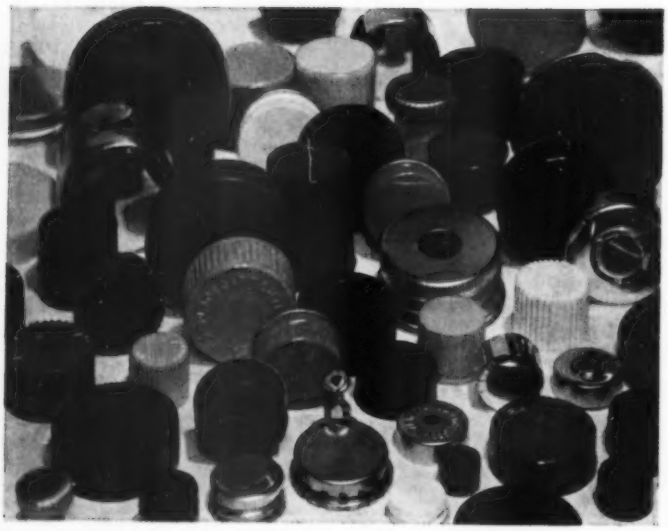
A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP

Vol. XXXI No. 12 DECEMBER 1960



CLOSURES by KORK-N-SEAL

for Coty LIMITED



Kork-N-Seal make a wider variety of closures than any other British manufacturer, for glass, metal and plastic containers. They are part of United Glass Ltd., Britain's leading makers of glass containers, so your closures and glass containers can be produced and delivered together.

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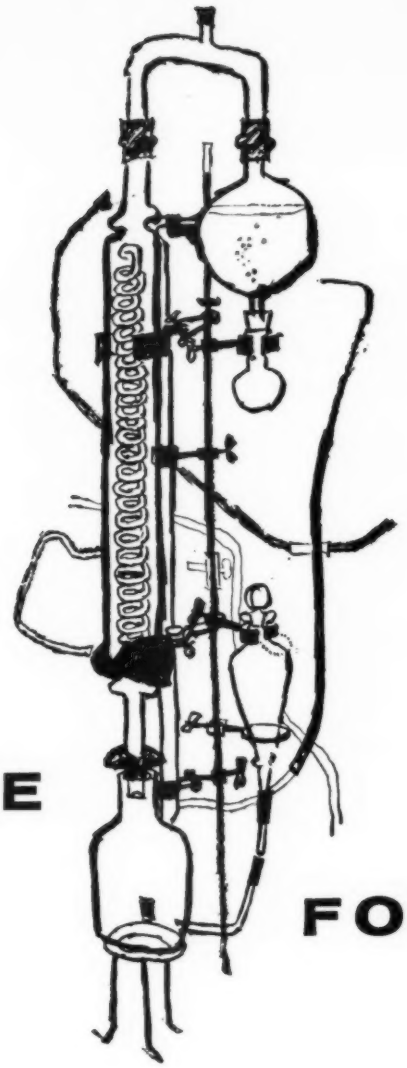

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C

Ascorbic Acid & Sodium Ascorbate

E

dl-alpha-Tocopheryl Acetate
dl-alpha-Tocopherol

Roche Products Limited, 15 Manchester Square, London, W.1
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BV/PH/2

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Maximum gross vehicle weight increased by 200 lb., front axle up-rated to 1650 lb., rear axle up-rated to 2850 lb.

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13″ wheel and tyre equipment give lower floor level and lower overall height. Plus lower centre of gravity, more comfortable ride, better cornering.

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Famous Vauxhall 4-cylinder over-square engine now fitted with special alloy, high-duty big end bearings which contribute to extra long life at high speeds.

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** All Bedford van prices include spare wheel and tyre.*

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Better buy BEDFORD

HEATING OR COOLING THESE CHEMICALS *DEMANDS*

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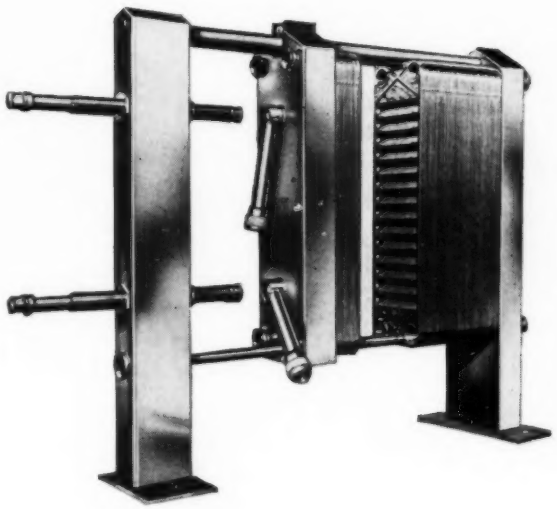

THE APV PARAFLOW

combines

- **High efficiency in heat transfer.**
- **Full accessibility of all surfaces for cleaning.**
- **Easy replacement of plates.**
- **Flexibility—easy to change capacity or duty.**
- **Space saving.**
- **Small liquid hold-up.**
- **Plates in stainless steel, titanium and other special materials to meet a wide range of corrosion-resistance requirements.**

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Acetic acid solutions
Acetic acid and vinyl acetate mixtures
Acetic acid and acetic anhydride mixtures
Acetone solutions
Ammonia solutions
Ammonium sulphate solutions
Ammonium phosphate (dibasic)
Beet Sugar juice (raw)
Chlorinated Brine
Calcium lactate
Caustic soda solutions
Colloidal solutions
Crotonaldehyde
Diphtheria plasma
Effluents from—
- ammonia stills
- bottle washing machines
- cellulose bleacheries
- dye liquor vats
- glue making
- laundries
- solvent recovery plants, etc.

Ethyl alcohol
Formaldehyde solutions
Glycerine solutions
Gelatine solutions
Glucose solutions
Latex
Lead fluoborate
Lime slurry
Metal polishes
Methyl alcohol
n-Methyl pyrollidone
Molasses solution
Oils—
- cottonseed
- linseed
- gas (debenzolised mineral type)
- hydraulic
- lubricating (turbine)
- mineral (various)
- quenching

Oleic acid
Petrolagar emulsion
Phosphoric acid solutions
Photographic developer solutions
Poly-vinyl acetate emulsion
Potassium carbonate lye
Sodium aluminate solution
Sodium hypochlorite solution
Starch suspension
Stearic acid
Stoddarts Solution
Sucrose solution
Sulphur dioxide solution (dilute)
Sulphite cooking acid
Sulphite waste liquor
Wax emulsions (thick)
White Spirit
Worts (various)
Yeast cream

This modern centrifuge is soundly designed, constructed, and suitable for research departments, pilot plant testing or general purpose small batch processing.
Because of improved production methods we are able to offer—QUICK DELIVERY.

21″ TYPE 86 STAINLESS STEEL CENTRIFUGE for laboratory or small batch processing

SIMPLE SAFE CONTROL

For safe, foolproof operation the single lever control is fully interlocked with the control panel, by means of a flameproof switch.
The adjustable stainless steel feed pipe and washing rose are standard fittings.

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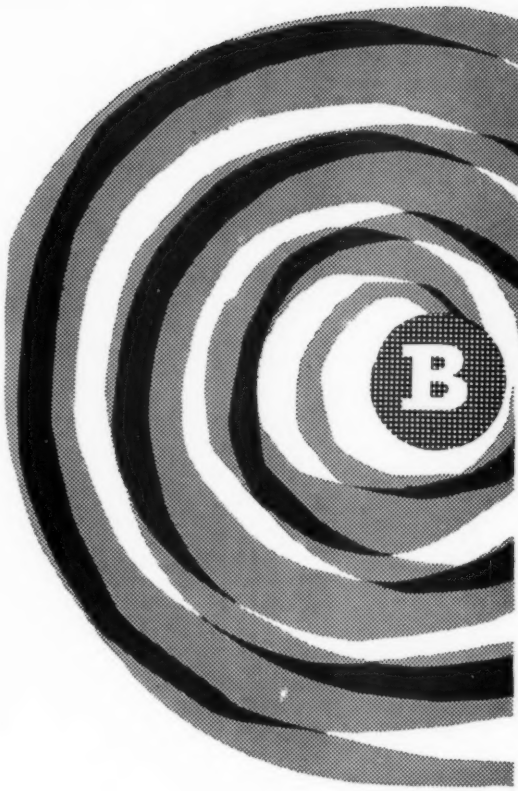

In the pharmaceutical industry Boric acid has long been acknowledged as one of the most versatile antiseptics available, and is used in many modern talc preparations. In ointments, dressings, eye lotions and similar products, boric acid maintains and extends its traditional place on the pharmacist's shelf.

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TGA BX 173W

Gosheron tapes

fulfil major packaging requirements

Above: The SPARTAN and TRANSOTAPE in use at Cascelloid Ltd.
Inset: TRANSOTAPE used for label protection at Extinguere Ltd.

Rapid carton sealing is vital to prevent a bottleneck in the packaging flow. The TRANSOTAPE/SPARTAN combination will treble the rate of flow and keep your packaging point clear. Simply push each carton across the mechanism. The **instant adhesion** of **TRANSOTAPE** and **SPARTAN'S one-second seal** do the rest.

Mounted in a table for stability—the SPARTAN is semi-automatic. Fitted in a powered conveyor system—it is fully automatic. Mounted in the upright, sideways or inverted position the SPARTAN operates efficiently. Two mechanisms mounted in opposition will simultaneously seal the top and bottom of a pack.

Demonstrations of the SPARTAN can be arranged in your works Write for further details and for regular copies of "Tape Times".

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meta-Aminobenzotrifluoride
1.4-(bis-Aminomethyl)cyclohexane
9-Anthracene aldehyde
Arachyl alcohol 99%
Behenic Acid
Behenyl alcohol 90%
Behenyl alcohol 98%
Benzidine acetate
Benzyl ethyl carbinol
Benzyl iodide
Benzyl isothiocyanate
Benzyl mercaptan
Bornyl benzoate
2-Bromoheptane
3-Bromoheptane
4-Bromoheptane
p-Bromophenacyl bromide
1-Bromo-3-propanol
Butadiene sulphone
Butene-2-diol-1,4
Calcium galactonate
Calcium glucoheptonate
Calcium glycerate
Capricnitrile 99%
Caprylnitrile 99%
Carbazole (very pure)
Cephalin (ex Hog's Brain) pure
Cerium salicylate
ortho-Chlorobenzyl chloride
6-Chloro-hexanol-1
3-Chloro-propanol-1
2-Chloro-pyridine
Colchicine USP XIV
Copper guaiacol sulphonate
Cupric dibenzene sulphonate hexahydrate
Cyclodecanone semicarbazone
Cyclododecane
Cyclododecanol
Cycloheptane
Cycloheptanol
Cycloheptanone
Cycloheptylamine
Cyclohexane-1,4-biscarbinol
Cyclohexyl urea
Cyclooctanol
Cyclooctanone
Cyclooctanone isoxime
Cyclooctylamine
Cyclopentyl urea
Cyclopentylamine
Decahydrocinnamic aldehyde
Decahydro-beta-naphthyl acetate
beta-Decalol (cis/trans mixed)
Decamethylene-1,10-dicarboxylic acid
Decamethylenedinitrile
n-Decane 99% (Olefin free)
Decanediol-1,10
1-Decene 95%
n-Decylamine 99%
Diaminodecane-1,10
Diaminododecane-1,12
Diaminoheptane-1,7
Diaminononane-1,9
Diaminooctane-1,8
Diaminoundecane-1,11
1,4-Dibromobutene-2
Dibromodecane-1,10
Dibromohexane-1,6
Dibromononane-1,9
Dibromooctane-1,8
Dibromopentane-1,5
Dichlorodecane-1,10
Dichlorohexane-1,6
2,3-Dichloro-1,4-naphthoquinone
Dichloropentane-1,5
Dicyclopentadienyliron
Dicyclopentylamine
Di-n-decylamine
Di-n-dodecylamine
Didymium salicylate
Diethanolamine salt of maleic hydrazide
asym-Diethyl ethylenediamine
Diethyl suberate
N-Diethyl amino acetonitrile
2,3-Dimercaptopropanol
2,2-Dimethyl-diaminopentane-1,5
a,a-Dimethylglutaric acid
Dimethyl-methylsuccinate
2,7-Dimethyl-2,7-octanediol
2,4-Dimethyl-3-pentanol (Di-isopropylcarbinol)
3,3-Dimethylpiperidine
2,5-Dimethylpyrrole
2,4-Dimethyl resorcinol
2,5-Dimethyltetrahydrofuran (water free)
Dimethyl thapsate
Di-n-octylamine 99%
n-Docosane 95%
1-Docosene 95%
Dodecahydro-beta-naphthyl acetate
n-Dodecane 99% (Olefin free)
1-Dodecene 95%
n-Dodecylamine 99%
2,2-Diphenylethylamine-1
n-Eicosane 95%
1-Eicosene 95%
1, 2-Ethanedithiol
4-Ethoxy-3 methoxy benzaldehyde
2 Ethyl-1-butene 95%
Ethyl-4-chloro-2-methylphenoxy acetate
6-Ethyldecanol-3
(Ethyl-(3-ethyl)-heptylcarbinol)
5-Ethylheptanol-2
(Methyl-(3-ethyl)-pentylcarbinol)
2-Ethyl-1-hexene 95%
5-Ethylnonanol-2
(Methyl-(3-ethyl)-heptylcarbinol)
6-Ethyloctanol-3
(Ethyl-(3-ethyl)-pentylcarbinol)
Eugenyl methyl ether
Ferric tartrate pure
Furfuryl acetate
Furoic acid 98% & 99·8%
Glyceryl-para-aminobenzoate
Heptamethylenedinitrile
2,2,4,4,6,8,8-Heptamethylnonane 95%
n-Heptane 99% (Olefin free)
n-Heptanol-2 (Methyl pentylcarbinol)
Heptanol-3
Heptanol-4 (Di-n-propylcarbinol)
1-Heptene 95%
n-Heptadeclamine pure
n-Heptylamine 99%
n-Hexadecane 99% (Olefin free)
1-Hexadecene 95%
n-Hexadecylamine 99%
Hexahydrobenzaldehyde
Hexahydrobenzyl alcohol
(Cyclohexane methanol)
Hexahydro-p-xylyldiamine
Hexamethylenedinitrile
Hexamethylene-imine
3-Hexamethylene-imino-propionitrile
3-Hexamethylene-imino-propylamine
n-Hexane 99% (Olefin free)
Hexanediol-1,6
Hexanediol-2,5
Hexanol-2 (Methyl-n-butylcarbinol)
Hexanol-3 (Ethyl-propylcarbinol)
1-Hexene 75%
Hexylcinnamic aldehyde
1-Hexyne
2-Hexyne
3-Hexyne
Lanthanum salicylate
Lauronitrile (n-Undecylcyanide)
beta-Mercaptoethylamine HCl;
Mercury acetamide
Mercuric succinimide
5-Methoxy-1-chloropentene-2
5-Methoxy-3-chloropentene-1
6-Methylcoumarin
3-Methylcyclopentanediol-1,2
3-Methylcyclopentanedione-1,2
Methyl cyclopentylamine
3-Methy-5-ethyl-heptanediol-2,4
3-Methyl-5-ethyl-nonanediol-2,4
2-Methyl-7-ethylnonanol-4
(Isobutyl-(3-ethyl)-pentylcarbinol)
3-Methylheptane 95%
3-Methylheptanediol-2,4
3-Methylheptanol-2
(Methyl-(1-methyl)-pentylcarbinol)
3-Methylheptanol-5
2-Methylpentanediol-1,3
3-Methylpentanediol-2,4
3-Methylpentanol-2
(Methyl-(1-methyl)-propylcarbinol)
2-Methyl-1-pentene 95%
4-Methyl-2-pentene 95% (mostly trans)
Methylsuccinic acid
Methyltuberate
Myristonitrile 99% (n-Tridecylcyanide)
Nitrocyclohexane
5-Nitro-2-furfuraldehyde diacetate
5-Nitrofurfurylidene diacetate
o-Nitrophenylacetic acid m.p. 138°C
Nonamethylenedinitrile
Nonanediol-1,9
5-Nonanol (Di-butylcarbinol)
n-Nonylamine 99%
n-Nonylcyanide 99%
n-Octadecane 99% (olefin free)
1-Octadecene 95%
n-Octadecylamine 99%
iso Octanoic acid
Octamethylenedinitrile
Octamethylene-imine
n-Octane 99% (Olefin free)
1-Octene 95%
2-Octene 95%
1,8-Octolactam
iso Octylamine
tri iso Octylamine
di iso Octylamine
n-Octylamine 99%
Palmitronitrile 99% (n-Pentadecylcyanide)
Pentadecane (traces Tetradecane)
n-Pentadecylamine 99%
n-Pentadecylamine pure
Pentamethylenedinitrile
Pentanol-3 (Diethylcarbinol)
2-Pentyne
Phenanthrene-9-aldehyde
2-Phenylamino-pyridine
(2-Anilino-pyridine)
1-Phenylbutanol-2
beta-Phenylethyl iodide
beta-Phenylethyl isocyanate
beta-Phenylethyl isothiocyanate
Phenyl isopropyl aldehyde
3-Phenylpropylamine-1
bis gamma Phenylpropylethylamine Base
bis gamma Phenylpropylethylamine dihydrogen citrate
3-Piperidino-propionitrile
3-Piperidino-propylamine-1
Potassium creosote sulphonate
Potassium mercaptophenyl-thio-thiodiazolone
1, 3-Propanedithiol
3-Pyrrolidino-propionitrile
3-Pyrrolidino-propylamine-1
Resorcinol diethyl ether
Salicyloyl hydrazide
Salicylhydroxamic acid
Sebacyl dichloride $COCl(CH_2)_8COC$
Serotonin creatinine sulphate
Sodium dichloroacetic acid
Sodium phytate
Sphingomyelin (ex cerebro)
Stearonitrile 99% (n-Heptadecylcyanide)
trans-Stilbene
Suberic acid
Terephthalaldehyde
Terpineol iodide
Terpineol saponate
Terpineol isothiocyanate
n-Tetradecane 99% (Olefin free)
1-Tetradecene 95%
n-Tetradecylamine 99%
Tetrahydrofurfuryl salicylate
Tetrahydropyran
Theophylline-7-acetic acid
Thioacetamide
Thiosalicylic acid m.p. 160°C +
Triamyl citrate
Trichlorodimethylphenylcarbinol acetate rediat
Trichlorohexahydro-beta-naphthol
n-Tridecylamine 99%
Trimellitic anhydride
2,6,8-Trimethyl-4-nonanol
Tri-n-octylamine 90/95% & 99%
dl-Tryptophane pharmaceutical
L-Tyrosine
2-Undecanol (Methylnonylcarbinol)
6-Undecanol (Di-amylcarbinol)
n-Undecylamine 99%
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Glass-lined equipment and careful supervision ensure that the "Coalite" Chemicals you receive maintain their consistent high standard of purity.

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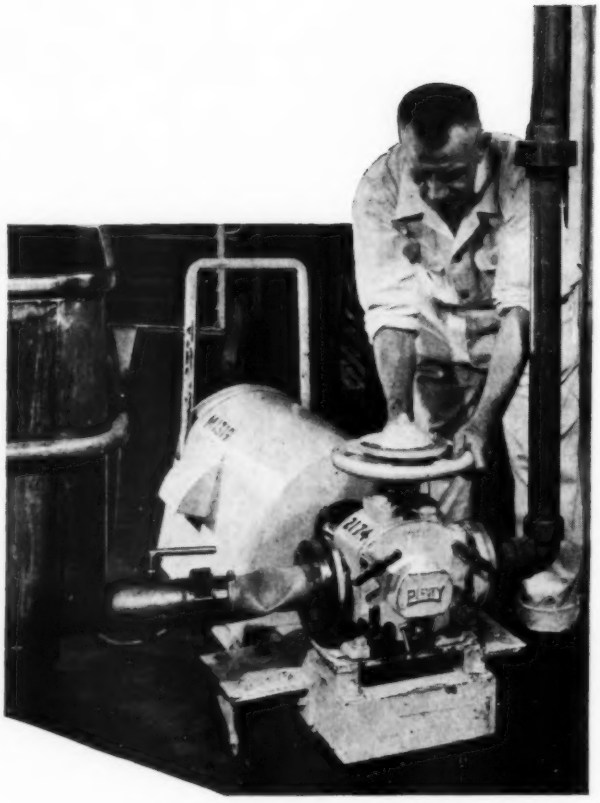
- Ideal for both light and heavy liquids
- Positive displacement for accurate metering



A 2" bore portable "Easiclean" pump handling dermatological creams at Genatosan Ltd.

Plenty "Easiclean" pumps are used for blending and metering additive concentrates antibiotics, chocolate, fruit juices pyrethrum extract, syrups, toothpaste, etc., etc.

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Eagle Iron Works
NEWBURY, Berks., England

Telephone: NEWBURY 2363 (5 lines)
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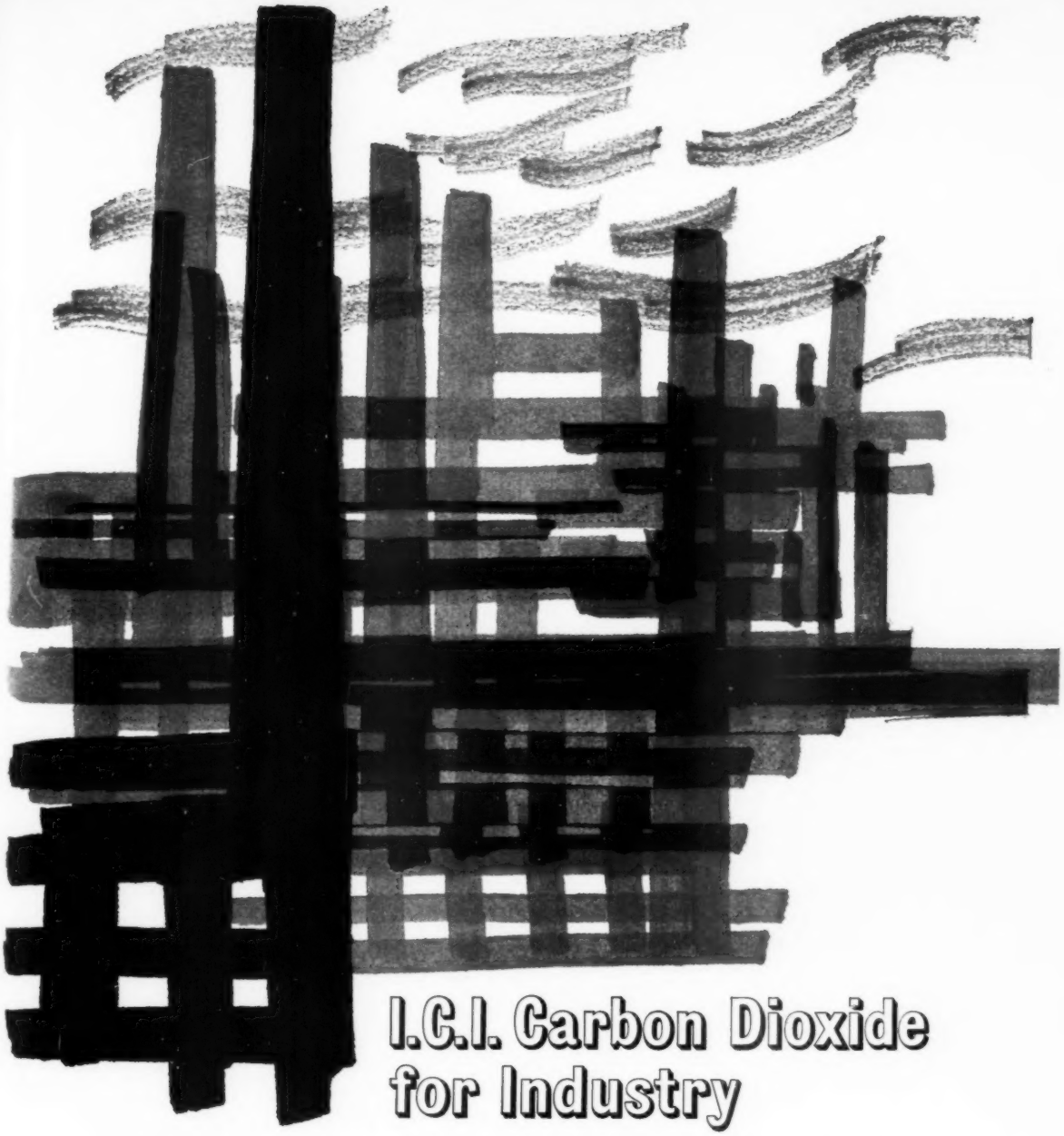

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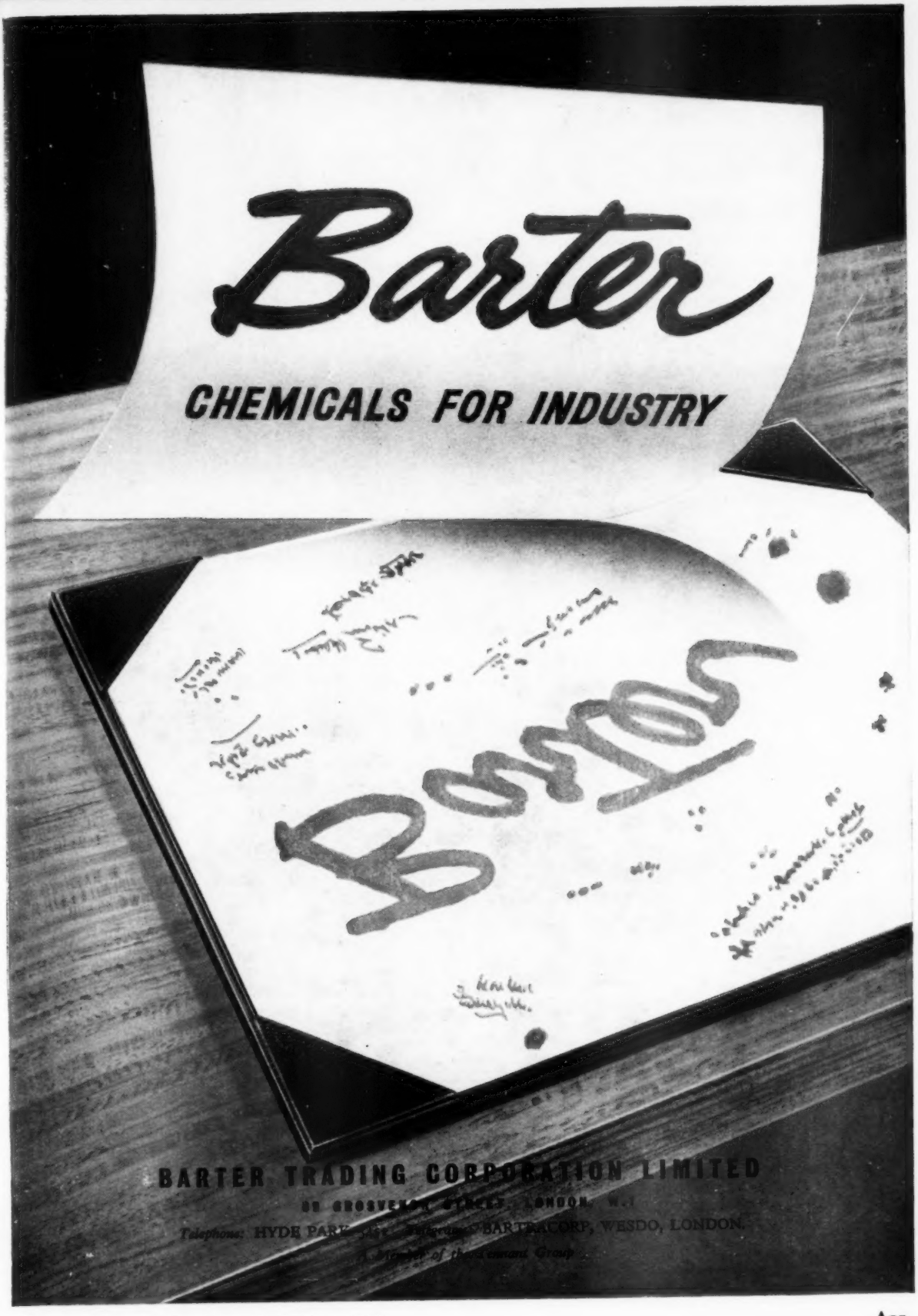
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SPC-11

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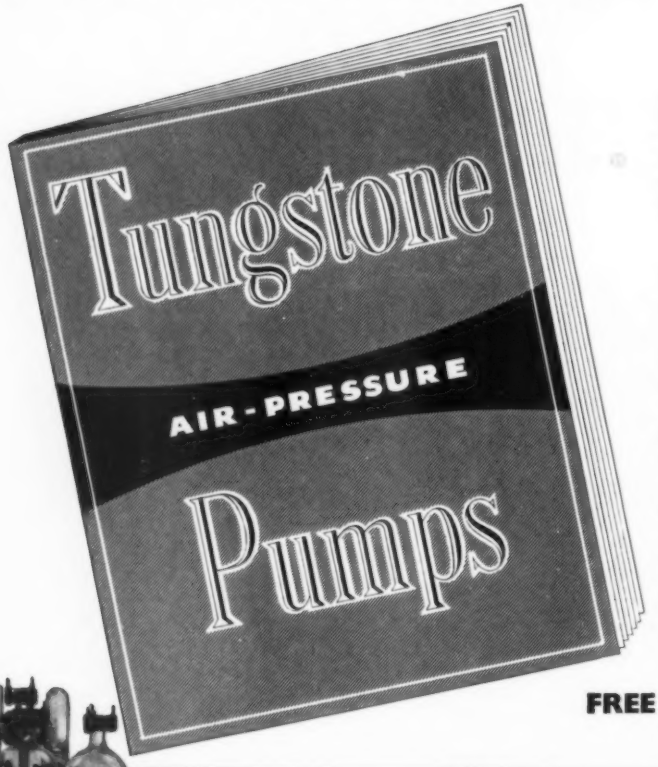
EBONITE PUMP, non-immersion type. Made in 3 sizes: 200, 375, 600 gallons/hour.

non-immersion LEAD PUMP. Made in 8 capacities: 375, 600, 800, 1,200, 1,500, 2,000, 3,000, 3,600 gallons/hour.

EBONITE PUMP, immersion type. Made in 3 sizes: 200, 375, 600 gallons/hour.

NO 'AWKWARD' LIQUID (CORROSIVE, EROSIVE, STICKY OR GRITTY) IS ANY TROUBLE TO

TUNGSTONE PUMPS

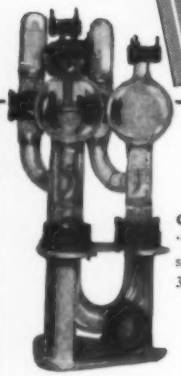


Which particular liquid in your business presents its pumping problem? Is it an acid, a slurry, a sludge . . . gritty, greasy, corrosive, erosive, sticky? A TUNGSTONE Pump will quickly take care of that—as many industries have proved.

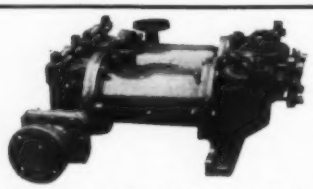
These fine pumps specially evolved for the handling of 'awkward' liquids have two valuable features: (a) the unit can be supplied in a range of materials which resist corrosion by any particular liquid, (b) there are no packings or glands within the unit and there is nothing to clog or choke—air is used as a piston, although it never mixes with the liquid: maintenance costs are negligible.

For any given pumping pressure the volume of air going to the pump can be controlled so that the pump's output can be varied from zero to maximum. The pump and whole length of delivery pipe containing valuable liquid can be emptied after each operation at the end of a shift.

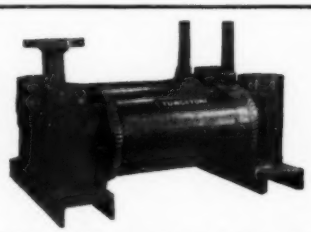
FREE *A fully explanatory, illustrated brochure describing TUNGSTONE Air Pressure Pumps, sent on request.*



GLASS PUMP— "Pyrex" brand Borosilicate Glass. 300 gallons/hour.



NICKEL/CAST IRON—10 sizes: 375, 600, 800, 1,200, 2,000, 3,000, 3,600, 5,000, 7,500, and 9,000 gallons/hour.
RUBBER LINED NICKEL/CAST IRON— 8 sizes, 800 to 9,000 gallons/hour.



LEAD PUMP—immersion type. Made in 8 capacities: 375, 600, 800, 1,200, 1,500, 2,000, 3,000, 3,600 gallons/hour.

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YP160

Carbowax* polyethylene glycols

There are good reasons why your next enquiry for polyethylene glycols—for whatever purpose you have in mind—should go to Union Carbide Limited. Here they are: * Range extends from molecular weight 6000 (hard wax) down to 200 (colourless liquid) * Backed by over 20 years manufacturing experience * Made in the latest UCL petrochemical plant at Hythe, Hampshire * Prompt and reliable service. Union Carbide maintains a consistently high standard of quality throughout the total range of these products. The Union Carbide technical service which is available to you is backed by more than 30 years of practical experience in synthetic organic chemicals.

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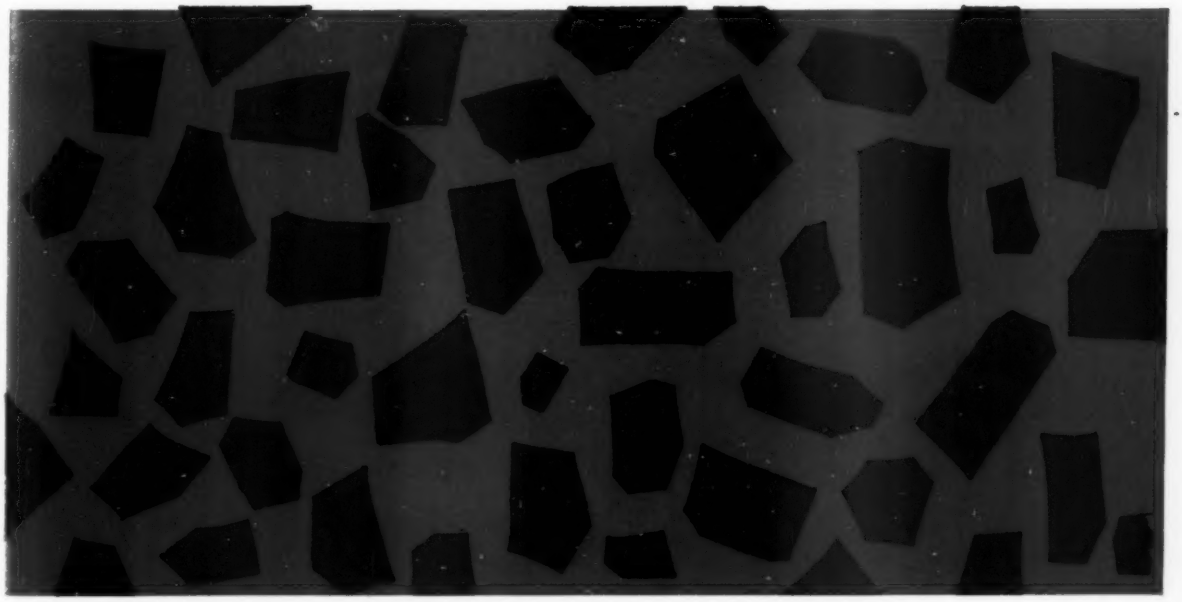

* The terms CARBOWAX and UNION CARBIDE are trade marks of UNION CARBIDE CORPORATION

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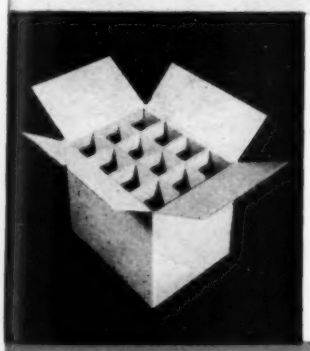

The combination of the latest advances in pharmacology with nursing skill exemplifies the protection of the vulnerable by those trained in guardianship. No less effective are the brains and skills behind R.C.C. producing the specially designed cases which give that *extra* care and protection to almost any product.

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- Incorporating a Polythene and parchment barrier.
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This NEW box

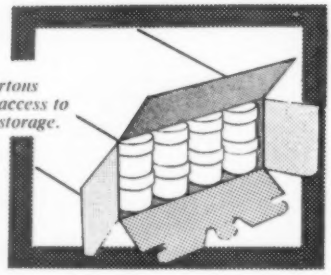
which incorporates a special feature to prevent the bottom from becoming displaced, has been designed as a quick and more convenient aid to dispensing.

Perfectly suited to hold powder. tablets, ointment or cream, the A.P.D. is invaluable when duplication of stock boxes must be kept to a minimum.

introducing the A·P·D

(ALL PURPOSE DISPENSING BOX)

All A.P.D. boxes are packed in spill-proof cartons specially made to give easy access to contents and for convenient storage.



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London Office: King's Bourne House, 229/231, High Holborn, London W.C.1. *Telegrams:* 'Omnibox' Holb. London. *Telephone:* Holborn 6383

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'Viskring' and 'Viskap' cellulose bottle closures set the seal on your product—both you and the customer can be confident that the contents reach him in perfect condition. 'Viskrings' and 'Viskaps' protect the contents, prevent adulteration, reduce evaporation and pilferage. What's more, these seals not only are hygienic, they *look* hygienic and, when removed, leave the bottle neck perfectly clean.

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Viscose Development Company Ltd

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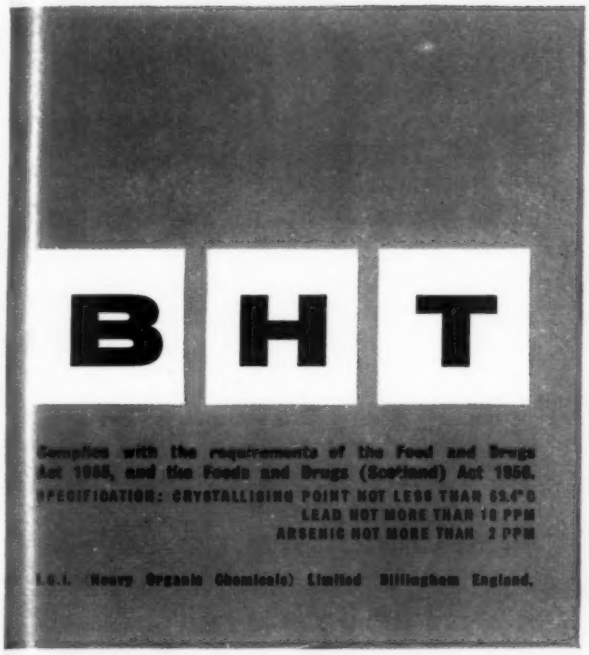
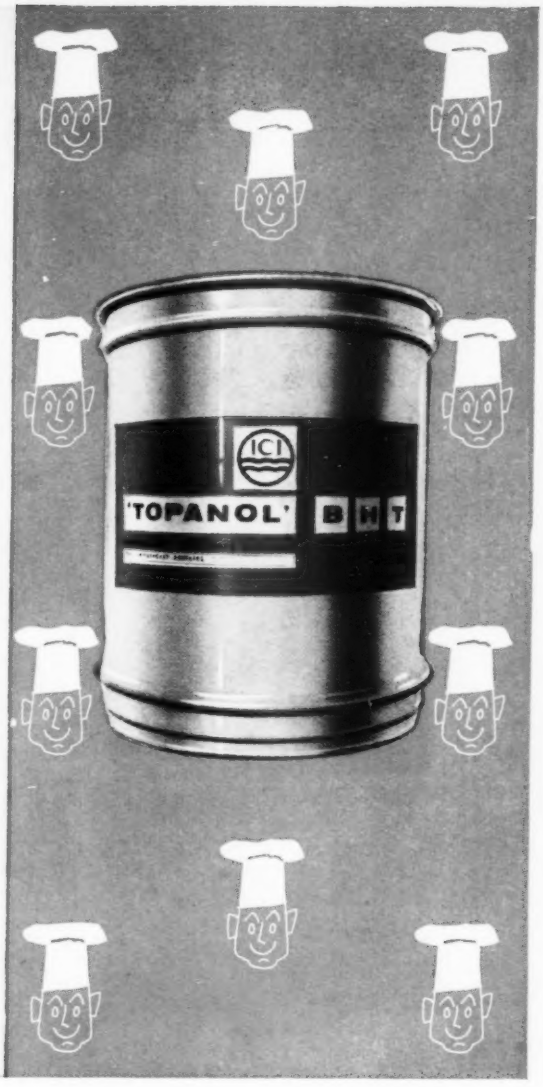
VC/17





'TOPANOL' BHT – a new food antioxidant

The *Antioxidant in Food Regulations, 1958*, permit the use of butylated hydroxytoluene in a variety of foods: 'Topanol' BHT is prepared with great care specially for this purpose.

'Topanol' BHT conforms with the requirements of the *Food Hygiene Regulations, 1955*, and other relevant legislation under the *Food and Drugs Act, 1955*.

'Topanol' BHT meets the following specification:—

Crystallising point	—	*not less than* 69.4°C.
Lead	—	*not more than* 10 p.p.m.
Arsenic	—	*not more than* 2 p.p.m.

Animal and vegetable oils and fats, and baked and fried foods containing these, are protected from rancidity at concentrations as low as 0.01% by weight—cooking temperatures do not destroy activity.

Paper and paper board wrapping impregnated with 'Topanol' BHT at low concentrations keep foods fresher by retarding rancidity at packaged food surfaces and on migrated films of fat.

The appetising appearance of food packs can be maintained by the use of plastic film wrappings (e.g. polythene) colour-stabilised and protected against embrittlement.

Natural and synthetic oil-soluble vitamins (e.g. in fish liver oils) and citrus and other essential oils are also the better for 'Topanol' BHT.

A PRODUCT OF

I.C.I. HEAVY ORGANIC CHEMICALS DIVISION

Full information on request

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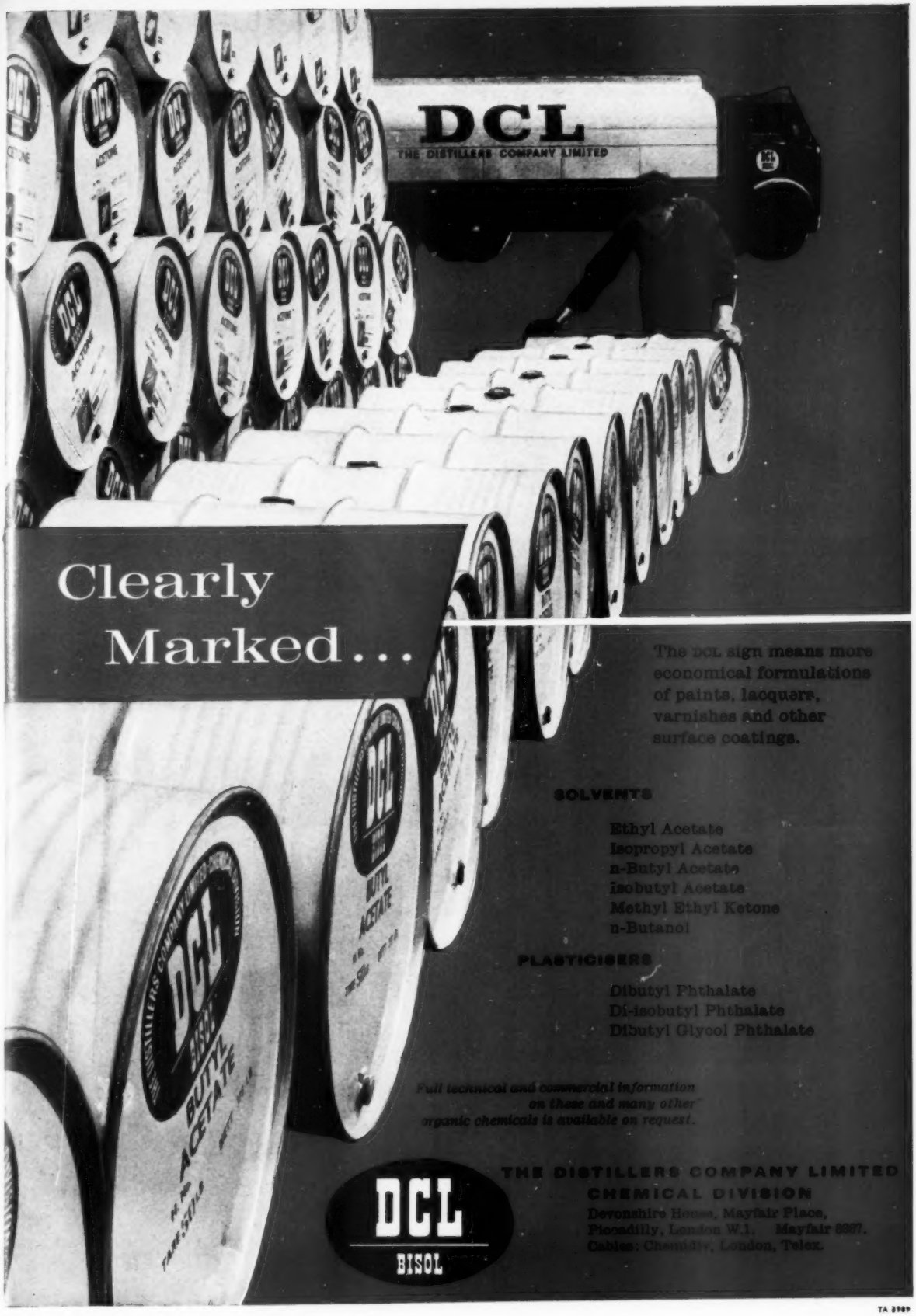

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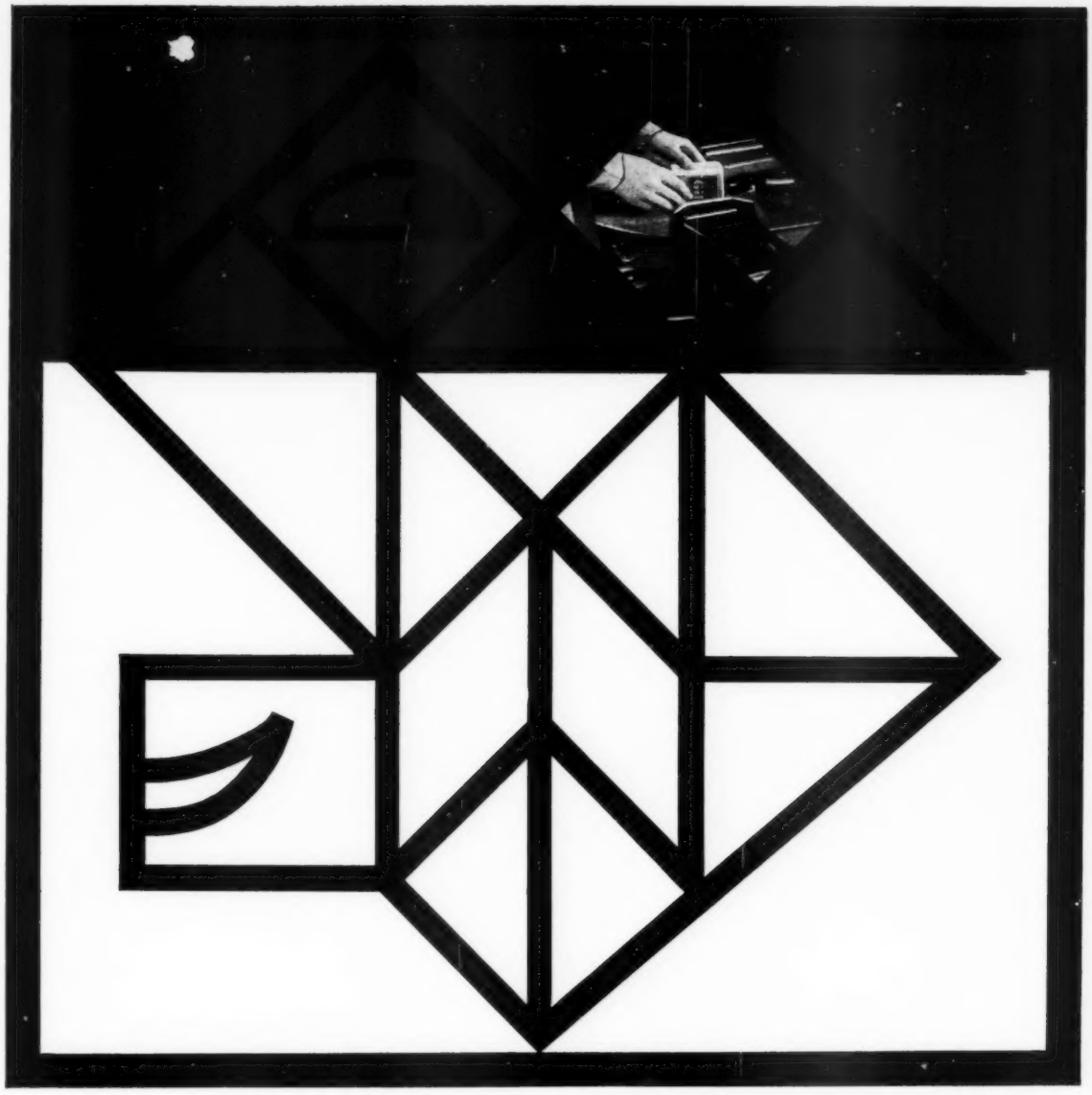

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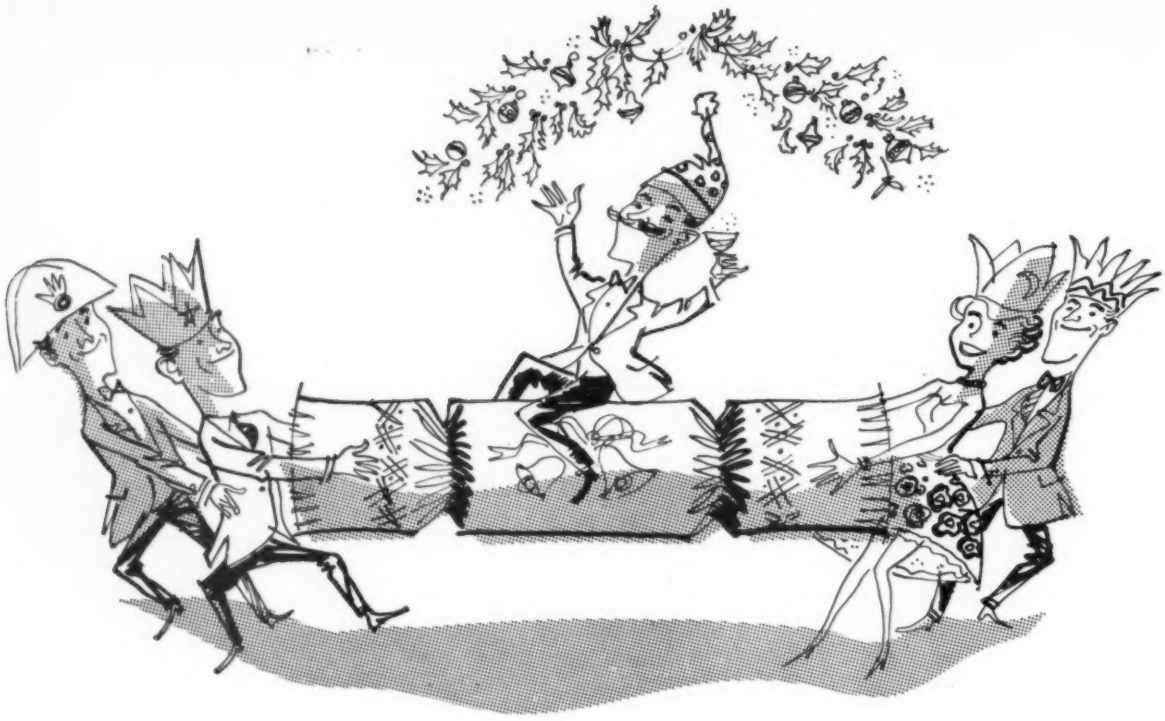

CRACKERS!

Who cares about chemicals, with Christmas just around the corner?
Nobody. Not even us*—and we **make** the things.
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We're just sending you and all our other customers, present and future,
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Morson

* **Postscript from the Sales Manager:**
Don't let this fool you. We shall go on selling chemicals right up to Christmas Eve. And when the junketing's over, we'll be right back, proving the truth of our slogan . . . 'If it's chemicals—Morson's will know!'

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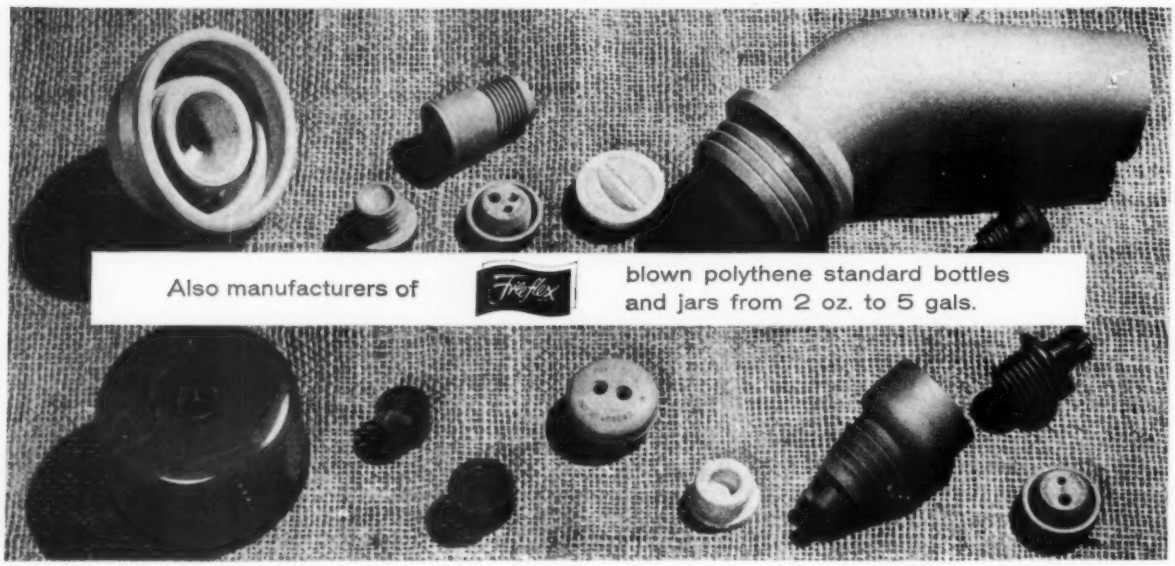
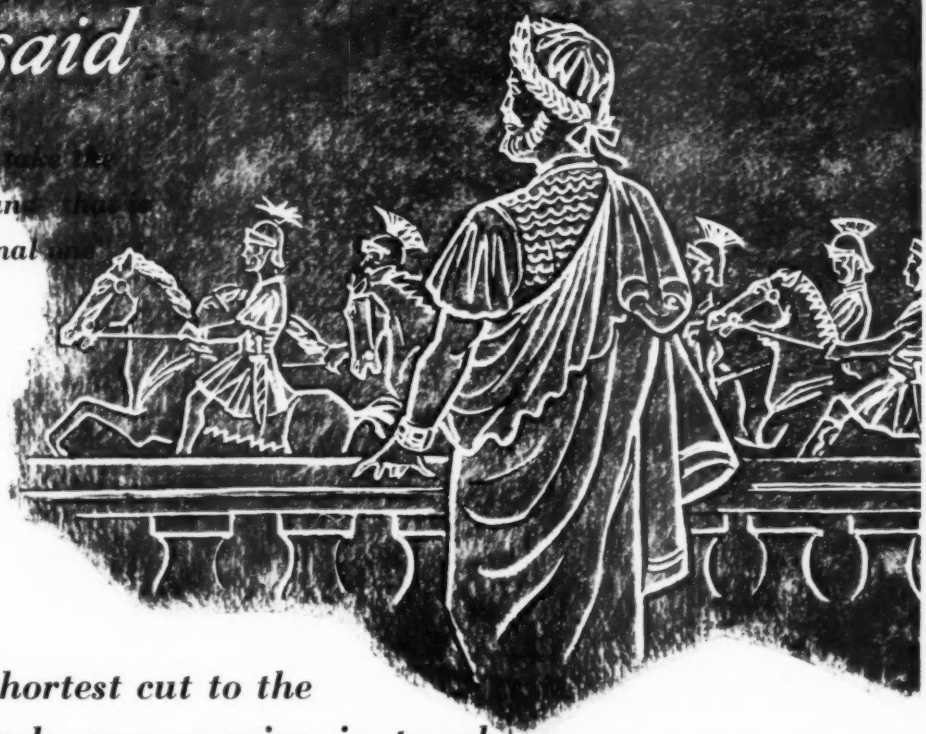


MARCVS AVRELIVS *said*

"Always take the short cut and choose the rational one"



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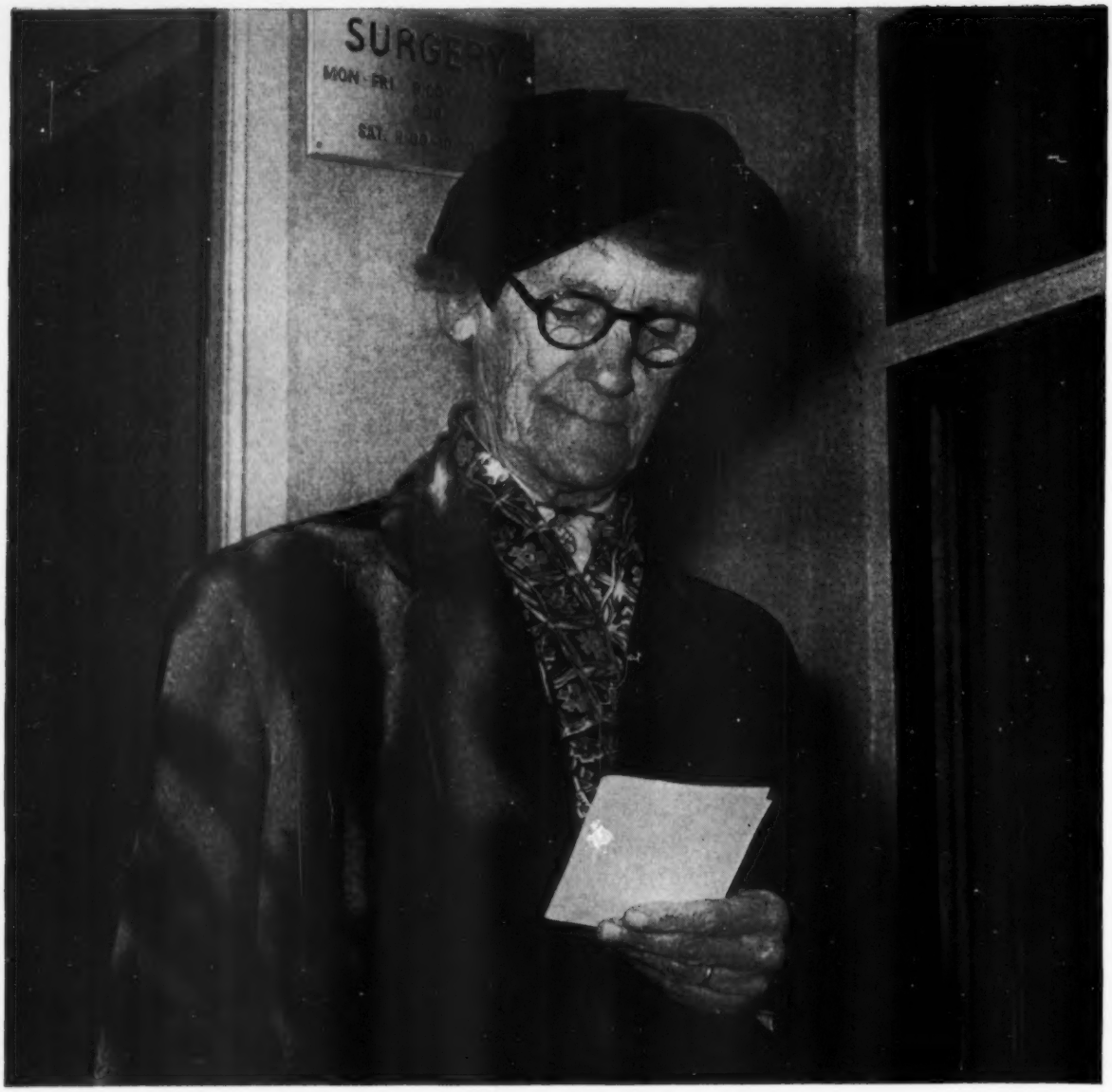

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μ, the micron, helps to fill many prescriptions. For the particle size of Sturge Precipitated Calcium Carbonate, widely used throughout the pharmaceutical industry, is measured in microns. The accurately controlled particle size, and hence density of Sturge P.C.C. makes it ideal for tablet-making.

Consistent particle size is but one of many standards applied to Sturge P.C.C. Each of the 24 grades is rigidly controlled throughout manufacture, and conforms to an established 'pedigree' of characteristics. The result is a fine chemical on whose high purity and known performance you can always depend. *Please write for the Sturge Technical Leaflets, which describe the grades of P.C.C. and include complete specifications.*

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TGA PCC 38

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We don't claim to be wizards at Jacksons, but we are able to think about our customers' problems as well as our own.
This simple attribute is really at the root of the Jackson service.
We want to know *where* a product is going to be sold; *who* is going to buy it; *what* is the competition. With this information we can really get down to providing a glass container that will sell your goods.
We don't claim to know better than your own marketing department, but we do know more about producing glass containers —
what a wonderful team we would make together!

Jackson packaging advisory service
A comprehensive service embracing design and advice on glass containers, closures, labelling, display boxes and outers. This service also offers to manufacturers, packing in containers other than glass, free market research facilities on 'design preference testing', 'container-in-use testing' and 'shelf testing', as well as an area test marketing service at a nominal charge.
Ring Museum 7263 with any problem you may have or write for informative booklet.

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Lectrodryers give you absolute control of moisture. A complete range of equipment is offered: for atmospheric or high-pressure conditions, for very small or very large volumes, for air, gases and certain organic liquids. Also available are standard dehumidifier units for air conditioning.

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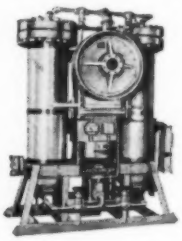
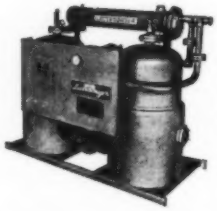
Air dryer as used in high pressure compressed air installations —600 lb./sq. in.



Dual-adsorber Budget Air Dryer, used where extremely dry air is required in small volumes up to 20 c.f.m. This unit weighs only 68 pounds.

An air conditioning dryer of the type used in such plants as sweet factories.



Latest design of fully automatic instrument air dryer.

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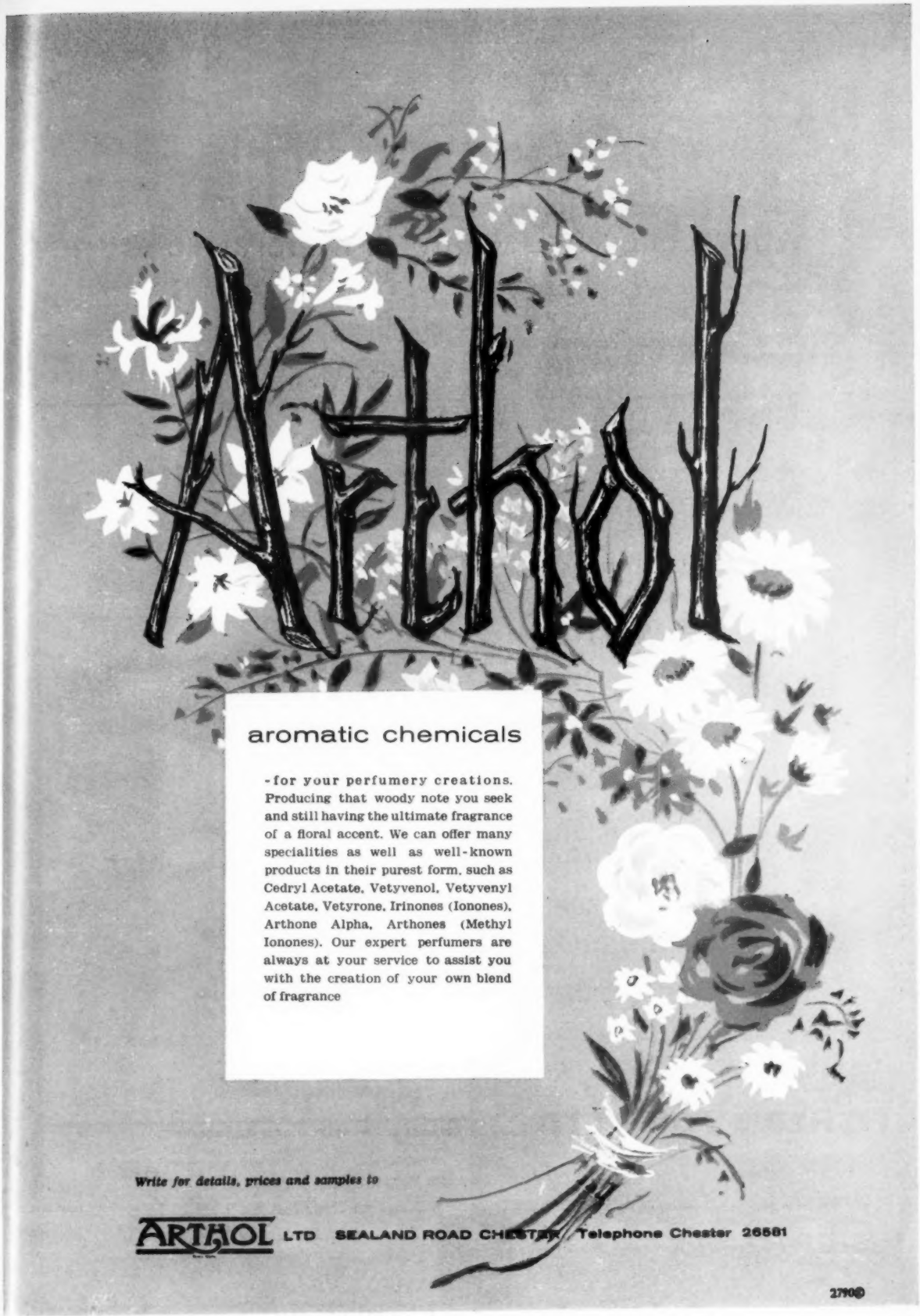
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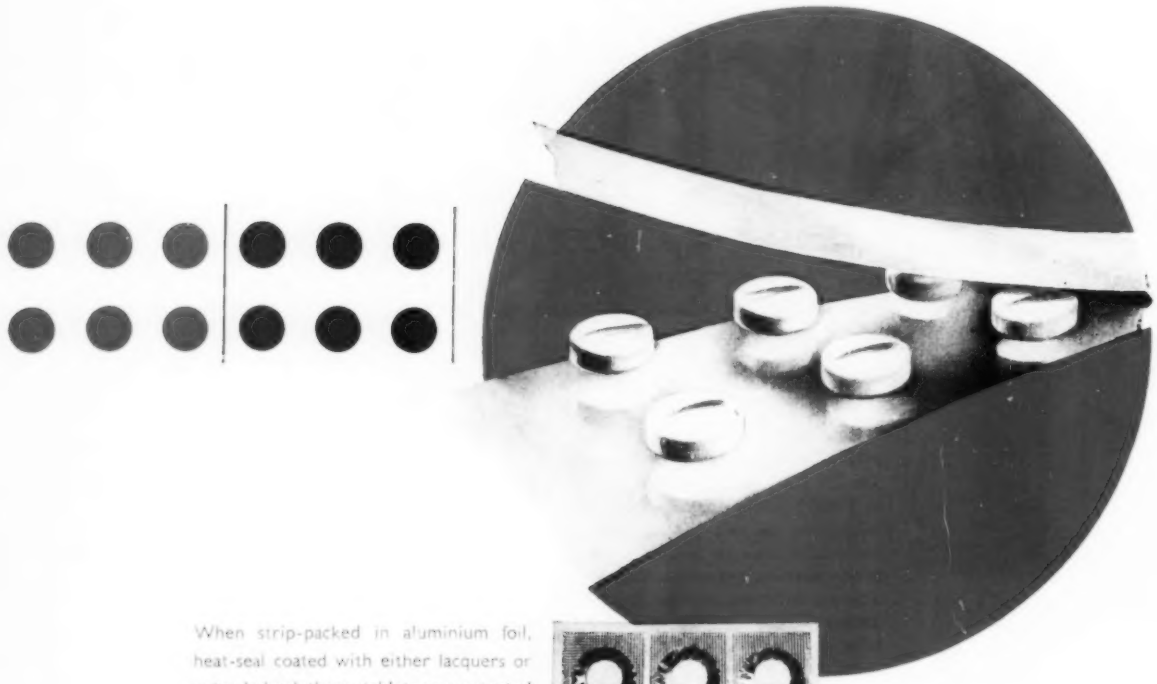
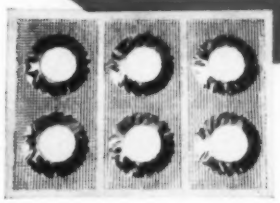


When strip-packed in aluminium foil, heat-seal coated with either lacquers or extruded polythene, tablets are protected against moisture and the chemical action of light. Manufacturers' own designs, incorporating dosage instructions, can be clearly printed by photogravure.



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As a result of extensive clinical tests, Dutton & Reinisch Limited announce a most important new class of FUNGICIDAL and BACTERIOSTATIC substances, based on Undecylenic-alkanolamides. Far milder on the skin than halogenated phenolic derivatives, and of far lower toxicity, these substances are highly effective against fungi infection such as ATHLETE'S FOOT as well as the yeast-like fungi associated with DANDRUFF. In having outstanding fungicidal properties allied to bacteriostatic characteristics these products offer a new weapon to the formulating chemist in his search for the most effective compositions.

- *Highly fungicidal and bacteriostatic*
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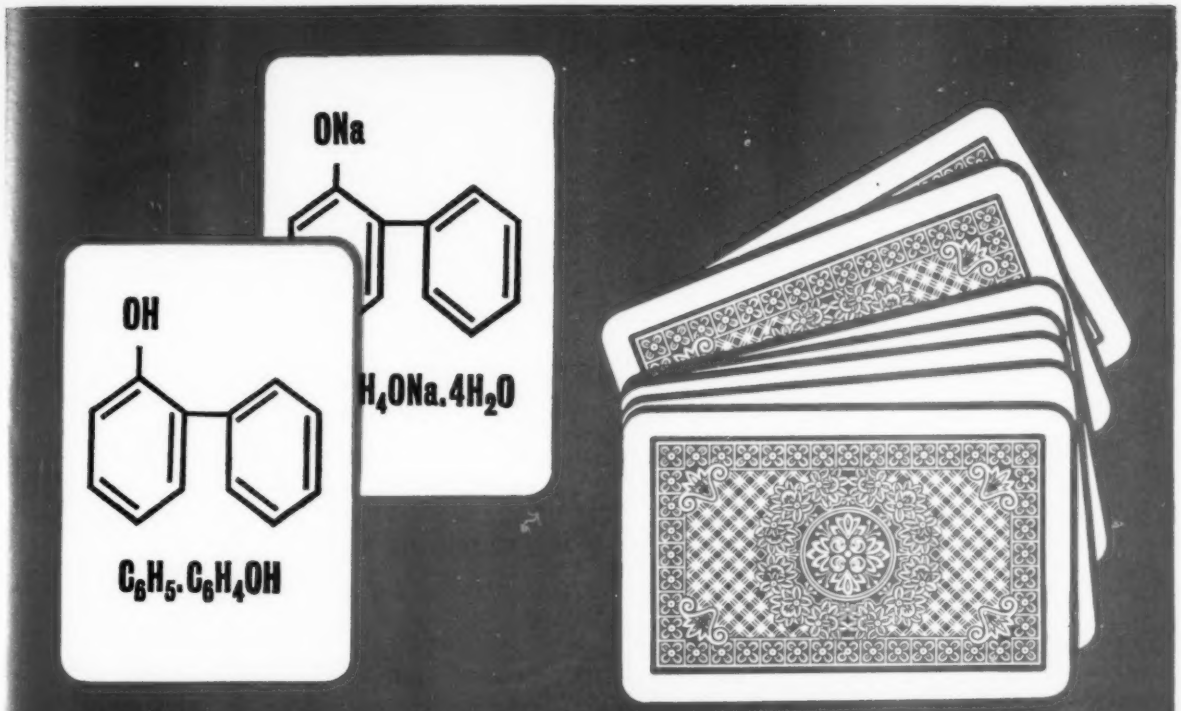


CARDS ON THE TABLE

Whatever your business — textiles or timber, adhesives or apples, paper or paint, hide-treatment or house-building — you'll find I.C.I.'s 'Topane' and 'Topane' WS bactericides are the best you can buy. We make no idle boasts — we simply put our cards on the table.

This is the table which compares 'TOPANE' with four other bactericides in common use

	Safety and Ease of Application (Max. 20)	Germicidal Efficiency (Max. 20)	Lack of Toxicity (Max 20)	Persistence (Max. 20)	Economy of Price (Max. 20)	(Max. 100)
Old type Non-Phenolic	10	2	10	1	20	43
Modern High Efficiency Non-Phenolic	12	20	1	20	4	57
Modern Phenolic Derivative (1)	16	9	14	15	8	62
Modern Phenolic Derivative (2)	15	12	10	17	15	69
'TOPANE'	**20**	**11**	**20**	**12**	**12**	**75**

'Topane' (I.C.I.'s brand of ortho phenylphenol) is soluble in organic solvents. It provides a valuable base for household and industrial disinfectants, for it extends their range of bactericidal effectiveness. Other specific formulations — for example, for the treatment of wet and dry rot in timber — may be economically based on 'Topane'.

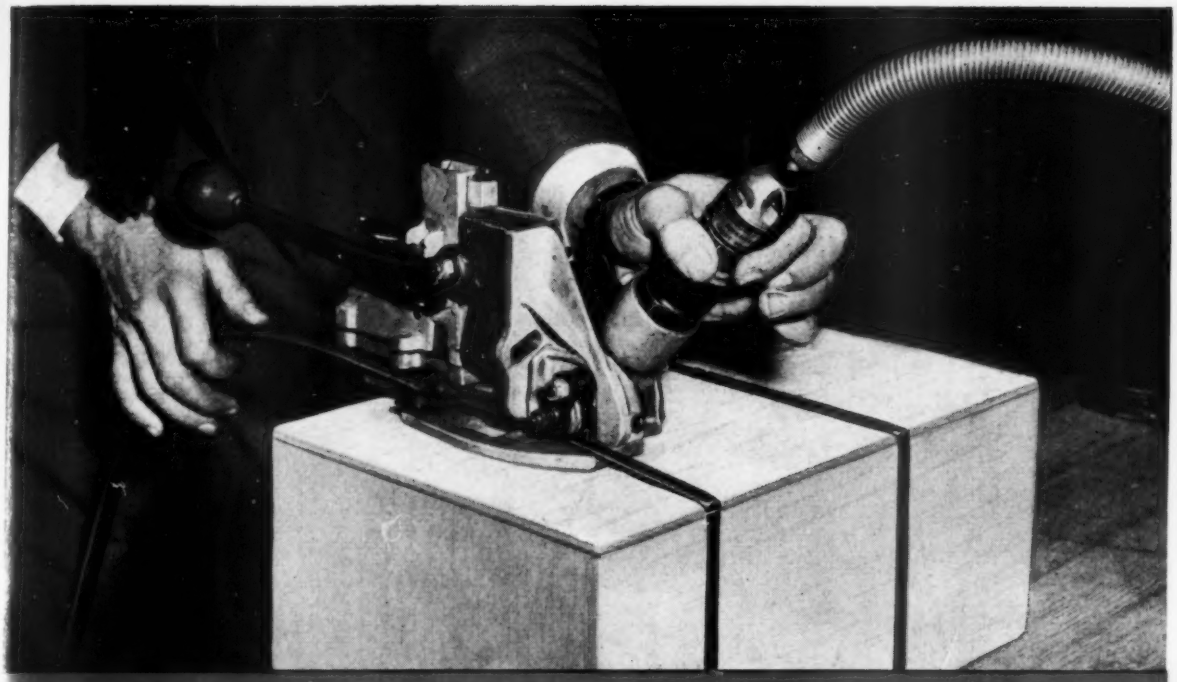
'Topane' WS (I.C.I.'s brand of sodium ortho phenylphenate) is the water-soluble grade of 'Topane'. It is valuable wherever health considerations call for a water-soluble germicide of low toxicity—e.g., in paper impregnation, cleaning ships' meat-cargo holds, etc.

Both 'Topane' and 'Topane' WS are supplied as non-dusting, free-flowing, safe-to-handle flakes.

For further information write to your nearest I.C.I. Sales Office or to

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

ICI



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If you tie your shipments...
here are 12 pointers to superior results at less cost

1 Steel strapping is strong. Even our smallest size has a tensile strength of over 400 pounds; our largest, over 15,000 pounds. This strength is unaffected by age, heat, cold, moisture, or dryness.

2 And it is low in cost. For equal lengths of equal strength, we haven't found anything that costs less than steel.

3 Tension is what binds your load together, or reinforces your package. You can pull high tension with steel strapping, and it holds without stretching.

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Manufacturing Chemist

Editor: W. G. Norris

Vol. XXXI, No. 12 DECEMBER, 1960

Subscription Rates: One Year £2 10s.; Three Years £5

A Publication of the Leonard Hill Technical Group:
Leonard Hill House, Eden Street, London, N.W.1 (Euston 5911).

Cables:—Abroad: Lenardil London. Inland: Lenardil Norwest London.

U.S.A.: 1214 Villa Drive, N.E. Atlanta, Georgia; 2515 Beverly Blvd.; Los Angeles 57, Calif. (Dunkirk 1-2241); 121 Ward Parkway, Kansas City, 12, Mo.; 501 Fifth Avenue, Room 611, New York 17, N.Y. (YUkon 6-2477); 681 Market Street, San Francisco 5, California (Exbrook 2-2612); 332 West Harrison St., Oak Park, Illinois (COlumbus 1-7906); 1501 Euclid Bldg., Room 426, Cleveland 15, Ohio (TOwer 1-2280); ITALY: Via Filippo Turati 3 (Palazzo Giardino), Milan; SWEDEN: Tunnelgate 19B, Stockholm; DENMARK: Palaegade 7, 3 Sal., Copenhagen K.

What are you reading? *A book.*

What kind of book? *A chemistry book.*

What's it about? *Chemical intermediates.*

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Topics and Comments

Tax threat to science

RIGHTLY the government and the public are more conscious than ever before of the importance of scientists and technologists and a lot of money is being spent to train more of them. But having given with one hand the State proposes to take with the other in a particularly stupid way. Over a hundred years ago our Victorian forefathers, scorned and ridiculed as they may be today, had the plain common sense to exempt from rates the buildings occupied by scientific societies. This excellent way of helping science offends the tidy minds of modern bureaucrats. It introduces anomalies and exceptions, they say. So a committee proposes that in future societies now exempt should be made to pay half of the full rateable value of their premises. Societies other than scientific societies will also be affected.

Many of our societies have premises in the heart of London and other cities. Imagine what the rates are on these desirable and eminently well sited buildings. Lord Adrian, past-president of the Royal Society, complained about this silly proposal in the House of Lords recently. The Minister of Science, Viscount Hailsham, said he would look into the matter and asked for more details. " There are difficulties in the way of exemption from any tax," he added. This is a curious remark. The government are not being asked to introduce a new system of exemption, but merely to leave alone one which has worked for over a century. What's difficult about that?

£20 million farm problem

WILD oats have been a major agricultural pest for 2,000 years and still the exact identity of the weed is obscure. In modern times the problem has become acute, and in the intensive cereal areas of Eastern England it is common to see whole fields of barley entirely dominated by wild oats.

Wild oats constitute the major unresolved weed problem in British farming. It has been estimated that the loss to this country's agriculture caused by wild oats approaches £20 million p.a. Yields are frequently cut by 50%. Wild oats usually ripen and shed their seed before the barley crop is ripe. Because of this they cannot be taken up with the rest of the crop but fall and replenish the reservoir of seed in the soil. The seed can remain viable for many years so that variation in ploughing depth can reinfest the surface layers of the soil.

It was against this background that an extensive trial programme took place this year with Avadex, a product that has been developed in America by the Monsanto Chemical Co., and will be distributed in this country exclusively by Boots. These trials have resulted in a 90-100% destruction of the weed.

Avadex (2 : 3 dichloro-allyl-di-isopropyl-thiolcarbamate) is a pre-seeding herbicide which is safe to use on all types of barley. The optimum rate of application is 3 pints per acre and increases in yield are apparent in most cases when wild oats are removed.

A valuable asset is that the new product is non-toxic and it does not build up in the soil or remain as a residue in the crop. The basic price of Avadex will be £8 per gal., giving a spraying cost of £3 per acre.

Fisons have also entered the field of wild oat control with a product known as Carbyne. It is best applied when the wild oats are in the 1-1½ leaf stage at a rate of 2 pints per acre; it has low toxicity but may cause skin irritation with repeated contact. The cost of spraying will be 70s. per acre.

Needed: more export enterprise

CHEMICAL PLANT exporters were urged to be more self-reliant and quicker off the mark in seeking business in the newly independent countries by Sir William McFadzean, president of the Federation of British Industries, at the annual dinner of the British Chemical Plant Manufacturers' Association. Speaking both as F.B.I. president and as the new chairman of the Export Council for Europe, Sir William McFadzean argued the need to pursue vigorously the first hint of new projects overseas. If the government of " Bongoland " proposes to build a new soap factory it is useless to wait for detailed requirements because the government, often advised by theoretical economists, is simply incapable of working out detailed technical specifications. So it is no use prospective tenderers writing to the local U.K. trade representative or F.B.I. representative for further information. They should seize upon the first hint and send their own representatives, armed with blueprints, to sell a complete process and plant.

This is only part of the fresh spirit of enterprise that must be instilled into British industry if the nation is to respond to the need for still more exports. The chairman of the B.C.P.M.A., Mr. Norman Frazer, also called for greater efforts. It is no use waiting for the government, firms must act on their own. The government has eased matters a little by permitting better credit facilities for companies dealing with great overseas projects. It could do more by easing the tax obstacles that hamper the sending of men overseas. Young married men, with responsibilities to wives and children at school, are reluctant to go abroad. The government should

abolish the irritations and penalties on men operating in exports, such as the tax on the illusory home saving during trips abroad and the difficulties placed in the way of wives accompanying husbands on trips where they can frequently be more effective than a man.

Relaxations of this kind are preferable to tax concessions on export business. Such concessions would retard progress made in abolishing export subsidies—a practice that makes a mockery of free and fair competition.

But when the government has done its part it remains for individual firms to get down to the job of getting into personal contact with potential customers and persuading them to buy. We badly need more initiative and urgency if the nation is to be diverted from the disastrous course of living beyond its means. In this connection we welcome the booklet " Exporting is Profitable " published by the National Union of Manufacturers, 6 Holborn Viaduct, London, E.C.1, which should dispel the fears of newcomers to exports and give some hints on developing a profitable overseas trade.

Fertilisers: protection and progress

At the first joint annual dinner of the Fertiliser and Superphosphate Manufacturers' Associations last month, Sir Clavering Fison, chairman of Fisons, referred to the import duties that have given the industry protection since 1932. Then it was essential, for the industry was threatened with near extinction by dumped foreign imports, yet the maintenance of a fertiliser industry at home was vital in the event of war; also, the industry took a third of the country's sulphuric acid production, and again it was strategically essential to maintain an acid industry. But nearly 30 years of protection has not led to inefficiency or technical stagnation. The industry, particularly during the past 15 years, can stand comparison with that in any other country for achievements in technology and efficiency.

Increasing production of fertilisers demands large investment and planning several years ahead. The home industry has found the necessary capital for meeting all demands. Sir Clavering hoped that if the government contemplated changes in the rate of fertiliser subsidy or in its balance between different plant-foods, such changes would be very gradual, otherwise production plans as well as the wise use of fertilisers on farms might be totally upset.

Fertiliser prices should be as low as possible. The industry has made a large contribution over the past three years; price reductions in that period, excluding the present year for which there have also been sizeable reductions, had saved farmers over £11 million.

Sir Clavering hinted at new research knowledge about the reactions that occur in superphosphate manufacture and in the granulation of mixed fertilisers. Presumably he meant the types of phosphate complex actually present as a result of rock acidulation or of the aqueous and heat-applying stages of granulation. " It is," he said, " really surprising to know the true contents of the compound fertilisers the industry has been selling all these years." More research than before was now being directed towards changes that occur when fertilisers are in the soil and when in contact with crop roots, and he believed that improved knowledge would lead to important advances in the next few years.

We agree that modern progress in the British fertiliser should be widely appreciated. Until about the 1920s it was an industry of many small producers. Probably no one has personally brought about more rationalisation than Sir Clavering Fison himself. His company now produces about 43% of the country's compounds, about 37% of the superphosphate and practically all the triple superphosphate. It is with the growth of larger-scale units of manufacture that many of the technical and processing advances have come, bringing further and wider progress through competition. To any one who knows fertilisers, there is ample truth in Sir Clavering's claim that protection has not brought technical stagnation and that fertiliser use must expand with or without subsidies. Unfortunately some critics of the fertiliser industry's service to the community have been poorly informed or misled by the bias of half-knowledge. It is not, for example, a criticism of the home industry if foreign fertilisers supplies are offered at prices lower than their prices in the country of origin—it is simply a revival of dumping.

Genetic hazards of chemicals

Due to the widespread use of radioactive materials in both industry and medicine, coupled with the development of the nuclear power industry, much attention has been focused on the genetic hazards of exposure to ionising radiations. This seems to have diverted attention from other factors around us that may produce changes in the mutation rate and hence cause genetic damage.

It is pointed out in the *Lancet* that many chemicals may cause mutation rates to increase in man, and that the possible dangers have been far less scrupulously studied than the effects of radiation. Added to this most of the experiments on the mutagenic effect of chemicals have been carried out on micro-organisms, plants and insects, but very little work has been done on mammals.

The most potent mutagenic chemicals so far discovered are highly reactive alkylating agents such as mustard gas and its derivatives. The epoxy resins, used in adhesives, paints and plastics, can also act as alkylating agents. Sterilisation of foods by exposure to large doses of ionising radiations is a new technique put forward as a potentially cheap and effective way of preserving food. Epoxides are known to form in irradiated foods, and these may

conceivably cause genetic change in the offspring of people regularly eating these foods.

Other chemicals known to have mutagenic properties are formaldehyde (used in food preservation) and some peroxides (formed in heated fats and therefore likely to be present in fried foods). Mutations in micro-organisms have been produced by some antibiotics and hormones, and by some components of weedkillers and contraceptives.

Not only have the majority of chemical substances not been studied for mutagenic effect, but even for those that have been found to cause mutations there is no information as to the quantities which will double the mutation rate in man. Only rarely are the long-term genetic effects of toxic chemicals considered when tolerable levels are determined for use in industry. Ethylene oxide and ethylene imine, both known to be mutagenic, would probably produce an incidence of genetic damage which would be completely unacceptable if it was produced by ionising radiations.

There is clearly a need for more research into the genetic and embryonic effects of many chemicals commonly used in the home and industry. The aim should be not only to identify such substances, but also to estimate the magnitude of the effect and study the uptake, distribution and metabolism in the human body. The new British Industrial Biological Research Association which is to be set up at Leatherhead might choose to interest itself in these problems.

Lucky breaks

WHEN the chemist Fahlberg, who died 50 years ago, discovered saccharin, he added one more example to those "lucky accidents" which have enlivened the pages of industrial history. It was Ira Remsen of Johns Hopkins University who set Fahlberg on to this discovery when studying aromatic sulphonation in Baltimore. Instead of obtaining the sulphamide of benzoic acid from oxidising the corresponding toluene derivative, Fahlberg hit upon the anhydride. He came home from the lab one evening, forgot to wash his hands before supper, found his bread tasting sweet, and returned to his bench to discover the reason. A similar accident attended the discovery of Sucaryl, the sodium (or calcium) salt of cyclohexylsulphamic acid, a sweetening agent 30 times as intense as cane-sugar. Here it was Sveda at Illinois who happened to put down on the lab bench a lighted cigarette while working, he replaced it in his mouth and, hey presto!

At times such romantic touches sound like fiction. A classic case was the invention of the first safety-glass by Edouard Benedictus. He accidentally dropped a large flask on the floor. It only cracked radially instead of disintegrating simply because it had contained a celluloid solution from which the solvent had evaporated to leave an inner skin of celluloid. The lucky Frenchman forgot the incident until he happened to read of a road accident in which flying glass caused injuries. This second hint from Dame Fortune was typical in such cases where a lucky turn-up of the cards brings inspiration (followed up by patient research into the cause, as Pasteur reminded us). One brings to mind Nobel's luck in discovering blasting-gelatine on his finger end, rather than in an apparatus, when he patched a cut finger with cellulose nitrate "dope" while working on nitroglycerine, and noted how the two were compatible. Becquerel was lucky when he left his photographic plate in the same cupboard as a uranium salt. And so was that worker who discovered a self-lining alundum furnace when he hosed a red-hot spot on the furnace lining which threatened to burn through, and thus solidified a layer of alumina to form a lining.

This year brings another anniversary with Charles Goodyear's death in 1860. The texts record how he was "lucky" in discovering vulcanising when he was arguing with his men and accidentally dropped a sulphur-rubber mix on to a hot stove. But since Goodyear died hopelessly in debt after some periods in prison for debt, it seems that this lucky deal of the cards went wrong somewhere.

Automatic dispensing

THE automatic dispensing of ingredients for batch mixing has been brought to a very advanced state at the new £2 million factory of Associated Feed Manufacturers Ltd., at Belfast. The system dispenses four different types of animal and vegetable oils to 16 mixing vessels. Each oil has its own independent pipework system and each mixer has four inlet connections. Thus, any combination of oils can be fed into the mixers.

The dispensing system is based on Parkinson Cowan Measurement rotary piston meters fitted with presetable controllers and operating solenoid-type valves—all the indications and controls being grouped on a central console.

To control the batch dispensing, the operator presets on the appropriate dial on the control console the amount of oil to be dispensed. He then rotates a selector switch to register a similar amount to that set up on the preset dial. This selector switch controls four proportioning solenoid valves, each adjusted for varying rates of flow. In this way the time taken to dispense the oil will be the same, no matter what quantity is set up on the dial.

The operator then selects the mixer into which the batch is to be dispensed by means of the mixer selector switch.

On the assumption that the batch is to be dispensed automatically, he next ensures that the changeover switch is set in the automatic position and then presses the "start" button. The circuit is now prepared for dispensing.

At this stage other control apparatus feeds meal into the appropriate mixer. When the level of the meal reaches the "depth" probe in the mixer, the solenoid valve for the appropriate oil or oils is

opened and the dispensing continues until the preset amount has been fed in. When this point is reached the equipment automatically closes the valve and resets the batch quantity controller to the same quantity ready for the next batch. Dispensing, however, cannot take place for a further batch until the operator has pressed the " start " button again.

Various signal lights on the mimic diagram indicate to the operator which oil has been selected and into which mixer it will be dispensed. Four signal lamps are grouped together at the top of the control panel to indicate which of the four proportioning valves are in operation.

If a mixer is used to store material overnight, a material level light on the control panel is illuminated and indicates to the operator that the mixer is in use and cannot therefore have oil dispensed into it.

If the " depth " probe circuit for automatic control develops a fault, the operator has the facility of moving a changeover switch to " hand operation "; this means that safety interlocks are overridden and dispensing can continue under visual supervision from the control console.

Cinnabar and alchemy

One of Spain's main indigenous chemical raw materials is still mercury. This metal occurs in the form of its sulphide and in that form is known as cinnabar. Although some progress in the efficient extraction of mercury from cinnabar has been stimulated by increased demands for this metal, traditional methods are still used in which the red ore is roasted in a furnace and mercury together with sulphur dioxide are volatilised. It is then necessary to separate the liquid mercury from the considerable amount of impurities with which it is contaminated.

Present-day production of mercury from cinnabar has strange connections with the alchemists of the Middle Ages. One of the main tenets of alchemy was that all base metals could attain the noble state of gold by addition of the philosopher's stone, which was supposed to act somewhat like a catalyst in bringing about such a transmutation. This stone was often described as a red powder, and was assumed by some to be the red ore, cinnabar. It seems possible that decomposition of cinnabar into mercury and sulphurous fumes may have led Muslim alchemists to propound the well-known " Sulphur-Mercury Theory " of the origin of metals (often attributed to one of the most famous Arabian alchemists known as Geber, who lived in the eighth century).

According to medieval alchemical thought, when the impure metals sulphur and mercury were conjoined in natural processes, under planetary influences, they gave rise to base metals such as tin and lead. When they were of high purity they gave gold or silver, and when each of these metals was of superfine purity they yielded the philosopher's stone.

As an outcome of the sulphur-mercury theory it was often supposed by adepts that the " seeds " of gold and silver could be extracted from these noble metals in the form of " sophic " sulphur and " sophic " mercury. These seeds could then be combined to yield the philosopher's stone. According to these views, an initial quantity of gold was required in order to effect transmutation. The stone could then be used in converting base metals into more gold so that the original gold was " multiplied." One of the favourite metals for " multiplication " was mercury. This choice has been curiously vindicated by modern observations that gold (atomic number = 79) really can be produced from mercury (atomic number = 80) in excessively minute amounts and at great cost.

Merry Christmas everyone

As we come to the end of the first year of a new decade in this bewildering and anxious twentieth century we can think of dozens of events that embed themselves in history. The political wind from the East blew hot and cold, with unscaled Summits and high-flying U-2s. Now there is a new Mr. K in the world headlines, the youngest-ever President of the United States, elected by the slimmest-ever popular vote. There has been a revolution in Cuba and Royal weddings in London and Brussels. In South Africa there has been murder and near murder and in the British Labour Party plotting and dagger wielding. The weather has been absolutely foul and Britain is becoming even more an aquatic nation. And, of course, there have been the jolly old strikes to remind us all of the crushing power of organised labour.

In the pharmaceutical and chemical industries there have been mergers and take-overs, following the pattern of the times. American companies have continued to take a keen interest in our industry. Investment-wise (an Americanism is appropriate) the industry disclosed plans for spending £12 million in the Manufacturing Chemist survey (published in May). So optimism seems the order of the day. Pharmaceutical exports have continued to edge up. There have been new products but none as outstanding as *Celbenin*, Beecham's answer to staphyloccocci. Of all the anniversaries of 1960 none was more impressive than the majestic Tercentenary of the Royal Society. And we have had new men at the top, from Unilever, I.C.I. and Boots downwards. The most enigmatic new Top Man is Mr. Enoch Powell, the new Minister of Health. He started off with a good and thoughtful speech about the Health Service. And then he came into the news again with a comment that though free Health Service drugs for private patients was right and proper they could not have them. Very puzzling.

Yes, 1960 has given us plenty to ponder on. In saying goodbye to it we wish all our readers:

Merry Christmas and a Happy New Year.

How Organon Tackle Sterile Product Manufacture

Built and equipped at a cost of around £750,000, the new manufacturing building of the Organon group at Oss, Holland, exemplifies the latest trends in the production of sterile products. Here is a description of the layout and equipment of this extremely functional building.

THOSE responsible for planning Organon's new building were concerned not only with making it conform to the latest ideas, but also with providing for future expansion and adaptation to quickly changing circumstances and methods of working.

The building was therefore laid out in the form of a small "h," and on a site large enough to permit expansion to a double "H" (HH) with considerable extension from each end of the six arms. The total floor area in 85,000 sq. ft.

The building has a reinforced concrete skeleton, with a façade of glass and plastic panels in an aluminium framework. The outer wall is thus not load-bearing but forms a skin over the concrete skeleton. One advantage of this form of construction is that sections of the façade may be removed from the ends of the building to facilitate the entry of heavy machines.

The two shorter arms of the "h" have three working-floors: basement, ground floor and first storey.

In the longer arm are situated the departments for making up and bottling sterile preparations and in the shorter arms those for tableting and sugar-coating. The section connecting the two arms houses offices, cloakrooms, toilets, lifts, staircases, etc., but no production rooms. Another storey has been built on the roof of this section, extending over part of the adjacent arms, and it is fitted out as a canteen.

PHOTOS SHOW: *Left, vials being delivered from an automatic filling and capping machine in the sterile area to the non-sterile corridor. Right, chests containing washed bottles and ampoules move on a belt through the infra-red sterilising tunnels before they are delivered to the sterile filling area.*

Solutions department

All sterile preparations, such as solutions in oil or water, suspensions, emulsions and sterile ointments, are made up in this department.

The solutions department is on the first floor, situated directly above the sterile bottling department. This makes it possible to convey the liquids straight to the bottling machines.

Aqueous solutions are prepared in a closed system under aseptic conditions, sterilised by Seitz filtration and stored in containers. This also applies to the solutions that can be sterilised afterwards (*e.g.* physiological salt solutions and solvents for freeze-dried products). This prevents the formation of pyrogens which can appear in non-sterile solutions after only a few hours. Sterilisation is nearly always carried out by filtration through Seitz filters; the objection that this method may lead to adsorption of active substances out of the solution is overcome by washing the filters before and after the filtration with special solutions. A sterilised glass filter is placed behind the filter press to capture fibres that may be shed by EKS Seitz filter pads.

The containers in which the solutions are stored are steam-sterilised beforehand. The steam-generators

use demineralised water. Sterilising with pure steam alone, however, is not completely reliable. For this reason the containers are first treated with dichromate sulphurous acid and thus at the same time freed from pyrogenic substances. Stainless steel storage tanks are sterilised with formalin and steam.

The making up of certain preparations, such as sterile eye ointment and steroid suspensions, demands treatment that is impossible in a completely closed system. This therefore takes place in a separate room next to the solutions department, which is connected to the sterile air supply to be described later. A work-cupboard is placed there also, connected to the sterile air supply and provided with ultra-violet lamps.

After being made up the preparations are placed in stores, and kept cool where appropriate, until the analytical, bacteriological and (possibly) pharmacological examination has taken place.

Sterile bottling department

The washing departments, sterilisation departments and sterile bottling department proper are situated next to each other on the ground floor forming one entity.

The room in which glassware is unpacked, and where there is consequently a great deal of dust, is divided by a wall from the room where the ampoules are placed in stainless steel chests after washing. The washing machines are built into this wall. Dust-free air is blown into the ampoule-packing room, thus reducing to a minimum the risk of floating particles, for moist glass picks up dust very easily. The chests containing the washed bottles or ampoules are then conveyed on a moving belt through one of two sterilisation tunnels at 300°C. for 20-30 min. All this practically eliminates the possibility of the survival of spores and also frees the glass from pyrogens. The tunnels are approximately 33 ft. long and divided into heating, sterilisation and cold sections. Heating is by infra-red elements above and below the belt. The sterilisation temperature also fixes the coating of silicone sometimes introduced in glassware during washing.

The tunnel ends in a store-room separated by a wall from the non-sterile part of the room and forming part of the sterile bottling department proper.

The autoclaves, adjoining the sterilisation tunnels, are used for sterilising rubber stoppers for injection bottles, tubes, pumps, filling needles and any other instruments for the bottling equipment.

Autoclaves are filled on the non-sterile side and emptied on the sterile side, the latter being connected to the bottling department. The autoclaves are used at the same time for sterilisation with ethylene oxide at an increased pressure and moderately raised temperature (40°-50°C.); the sterilisation period is therefore so reduced that the autoclaves do not need to be locked too long (the temperature factor is 2·74), and the period of sterilisation is in inverse proportion to the concentration. In this way plastic objects, such as polyethylene eye-droppers and metal tubes whose varnish is not proof against heat are sterilised. Even complete apparatus with a motor, such as colloid mills for the preparation of sterile ointments, can be sterilised in this way. In addition, the overalls of the staff in the sterile bottling department are all gas sterilised.

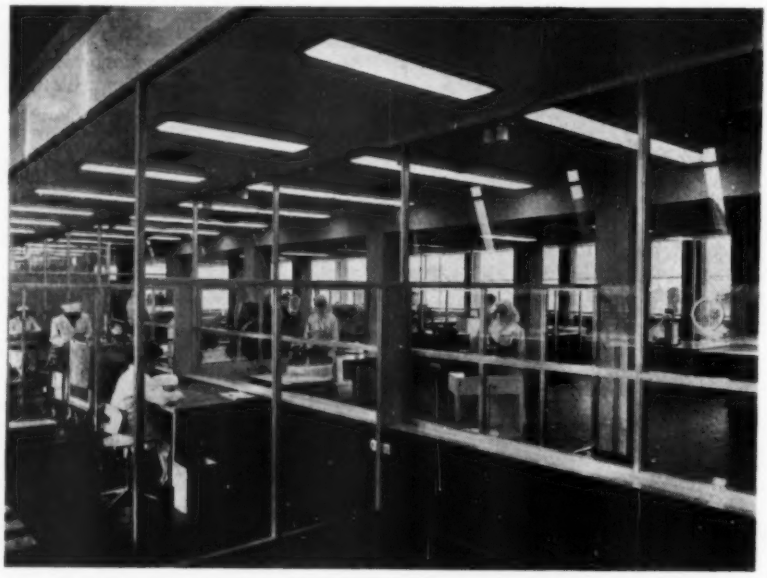
A non-explosive mixture of 10% ethylene oxide and 90% carbon dioxide is used for sterilisation. The cylinders containing this mixture stand outside the building; this applies to all the other gas cylinders, such as those containing CO_2 gas, nitrogen and oxygen. From here, the gas is taken through tubes under high pressure to wherever it is needed.

The rooms into which the tunnels and autoclaves lead, as well as those in which the ampoules and bottles are filled, are connected to a special installation for the supply of sterilised air. In the sterile bottling department the air is changed about 18 times an hour, which means that every hour 84,700 cu. ft. of air must be drawn in, filtered and sterilised.

Sterilisation is carried out by an electrostatic precipitator. This method was selected after comparative tests carried out in 1952 in Organon's pharmaceutical research laboratory, where the results were tested by the Bourdillon apparatus, which has now established the suitability of this type of steriliser for application on a large scale.

Conclusions were also drawn from other facts discovered during the preliminary investigation. The regular opening and shutting of doors causes undesirable currents of air; this can be considerably reduced by dividing the room into cubicles with partitions, which do not continue to the ceiling. These cubicles also screen the production lines from each other.

The bottling equipment is as far as possible built into plexiglass cases; on one side empty sterilised ampoules or bottles slide out of their boxes down a sluice, on the other side they leave the case filled and sealed. The cases are connected



Non-sterile partitioned corridor in the foreground where the vials are delivered after they have been filled and capped in the sterile area behind.

The new pharmaceutical building of the Organon group at Oss. The building has a reinforced concrete skeleton with a façade of plastic and glass panels.

separately to the supply of sterile air, so that an excess pressure arises with respect to the work-room (which itself has an excess pressure with respect to the surrounding passage).

The number of people working in the sterile part is kept to the minimum. The partitions between the cubicles in this part continue into the surrounding passage, thus forming corresponding non-sterile cubicles in which all those operations take place that do not have to be done aseptically. For example, the bottles leave the sterile part after the rubber stopper has been put in; the aluminium cap is spun on in the non-sterile part.

The storage container with the liquid that has to be bottled also stands outside the sterile section and is connected to the bottling apparatus by a tube through the wall. The delivery of new solutions for storage as well as the removal of filled ampoules and injection bottles thus takes place outside the sterile section. Only the doors of the freeze-drying apparatus are situated in the sterile section; the mechanical part is attended to in the non-sterile section.

Thus only the girls who check the bottling apparatus itself, their supervisors and those who bring the ampoules and bottles from the sterile store to the bottling apparatus need enter the sterile area while the process of bottling is largely mechanised. This mechanisation has even greater significance here: the less the materials are handled, the smaller is the risk of infection.

Here all the products are aseptically bottled, even those that can be sterilised afterwards. In spite of the high speed of modern bottling machines, the total time required for filling one bottle is too long for one to be certain that no pyrogenic substances have been formed in the time between bottling and after-sterilisation. Also solutions in oil are difficult to sterilise, so that there is every reason for excluding all sources of infection whenever possible. The same standard of sterilisation is required for ophthalmic preparations as for injections, although this rule is not adopted in all pharmacopœias.

The work-rooms for further handling of sealed ampoules and bottles do not have to satisfy special demands. This further handling begins on products arranged for the purpose with after-sterilisation in an autoclave. The proper sealing of the ampoules is checked in a vacuum cabinet. Ampoules with solutions in oil are degreased in an acetone bath. Then follows the visual check in the inspection department.

The finished products are placed in various storerooms according to their type, to be packed later.

Tableting and sugar-coating department

The preparation department lies above the tableting department, to facilitate vertical movement.

It is divided into three rooms; one for moist granulation, one for drying and one for briquetting, dry granulating and mixing. In the latter department the air is conditioned to a relative humidity of about 45%.

The air drying plant is situated in the basement, in the tableting arm of the building. Here 1,147,700 cu. ft. of air are filtered every hour and cooled or warmed according to weather conditions to 9·5°C. This air enters the rooms requiring dry air through ventilators, *via* air heaters. These raise the temperature in the work-rooms to 22·5°C. or more, whereby the relative humidity is kept at 45% or less. Air must be supplied to deal with the considerable dust problem both in the room itself and locally on each piece of apparatus, the total volume of air being changed 25 times an hour.

The storage room for the finished granules and the tableting department itself is connected to this conditioned air supply.

At night the central system is switched off; independent automatic air-conditioning units then come into action in the store-rooms and maintain the relative air-moisture constant, even during a breakdown.

The method of drying the air by cooling it to a fixed temperature and then re-warming has been selected for its simplicity. It is not easy to bring the relative humidity below 45%, but then most of the products do not require this; generally it is more important to keep the moisture content constant. For this reason the counting department for the tablets enjoys the same conditions. Should a certain product require a lower relative moisture, then this can be provided locally by installing a separate installation, *e.g.* a freezing installation, or a lithium chloride dryer. Moreover it is advisable to adapt the formulæ as far as possible to the conditions prevailing in the work-rooms concerned.

In the tableting department the presses stand in a row, facilitating the regular delivery and disposal of granules and tablets. The granule bins hang above the filling-funnels. In this department also a great deal of dust is created (on the presses), so that the air must be changed 10 times an hour.

Coated tablets can be made here. Usually however the traditional sugar-coating is employed. In the sugar-coating department the pans are arranged in one row according to the incidence of the light. The air in the places where tablets are

(Continued on page 524)

Carbohydrates in the Chemical Industry

1. Simpler Carbohydrates and Derivatives of Glucose and Sucrose

By Greville Machell, B.SC., PH.D.

Carbohydrates and their derivatives are chemicals of immense commercial importance. In this series Dr. Machell discusses the chemistry of these compounds and their applications in major industries such as plastics, textile fibres, detergents, pharmaceuticals and foods. His first article covers the simpler carbohydrates including glyceraldehyde, erythrose and erythritol, the pentosans, glucose, fructose, sucrose, and some of their more complex derivatives.

THE carbohydrates occur profusely throughout nature and as a group are of immense commercial importance. Carbohydrates are synthesised in plants from carbon dioxide and water under the influence of sunlight, the process being catalysed by chlorophyll. As a source of organic chemicals, they are basically in a stronger position than coal or oil, since they are perennially renewed, while coal and oil deposits must eventually become exhausted.

The term carbohydrate had its origin in the belief that all the naturally occurring compounds of this class, such as glucose, $C_6H_{12}O_6$, sucrose, $C_{12}H_{22}O_{11}$, and cellulose $(C_6H_{10}O_5)_z$, could be represented as hydrates of carbon, *i.e.* $C_x(H_2O)_y$. This rigid definition soon proved untenable, since it excluded a number of substances which were clearly closely related to glucose, etc., and yet could not be represented as hydrates of carbon.

The nomenclature of carbohydrate chemistry is exceedingly complex, this complexity arising from the many different ways in which it is possible to arrange in space say the 24 atoms in the formula $C_6H_{12}O_6$. In fact there are at least 24 distinct carbohydrates possessing this formula. However, of these only five occur in nature, two being of commercial importance; the majority of the remaining compounds have been synthesised in the laboratory, and are of academic interest only.

Glyceraldehyde

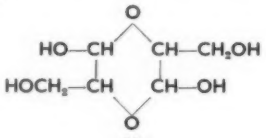
Glyceraldehyde, also known as glycerose, is usually regarded as the simplest member of the carbohydrate series. It does not occur in nature as such, but the phosphate derivative is of considerable biochemical interest. Glyceraldehyde itself is now produced synthetically in a recently developed process designed primarily for the production of glycerol. In this process propylene is converted to acrolein by oxidation in the vapour phase in the presence of a copper oxide catalyst at 350°C. The acrolein is purified by absorption in water followed by distillation, and is then oxidised to glyceraldehyde with hydrogen peroxide, (I)

$$CH_2{=}CHCH_3 \longrightarrow CH_2{=}CH.CHO \xrightarrow{H_2O_2} CH_2OH.CHOH.CHO$$
(I)

probably using as catalyst tungstic or osmic acid. In the final stage, the glyceraldehyde is hydrogenated to give glycerol.

Glyceraldehyde is now commercially available in the U.S.A. from the above process, and with its three functional groups is a versatile chemical intermediate. The hydroxyl groups may be esterified with acid chlorides and anhydrides, and polyesters formed with dicarboxylic anhydrides have good adhesive properties. Reaction with carbonyl compounds gives dioxolanes, and with alcohols and thiols, acetals and thioacetals are produced. Glyceraldehyde condenses with phenols, ureas and aryl sulphonates to give polymers useful in adhesives and for the modification of established polymers. Applications in the treatment of paper, textiles and leather are also foreseen.

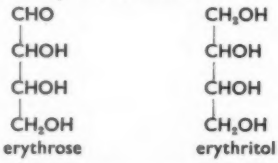
Glyceraldehyde crystallises from aqueous solutions as the dimer. (II)


(II)

This dimer is a cyclic hemiacetal and also a dioxan derivative, and other potentially useful dioxan derivatives may be prepared from the dimer.

Erythrose and erythritol

Erythrose and erythritol are examples of carbohydrates containing four carbon atoms and are closely related as shown by the formulæ:

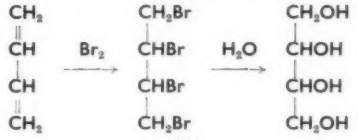


Erythrose is a synthetic compound and may be prepared by a number of routes. The most attractive one from the

Some of the many products which can be produced from furfural, which is obtained on a large scale from oat hulls and corn cobs.

points of view of availability of starting material and yield is the oxidation of glucose with lead tetra-acetate.[1]

Erythrose may be reduced to erythritol quite readily with hydrogen and a suitable catalyst, but this method is not in commercial use. An alternative is halogenation and subsequent hydrolysis of butadiene. (III)

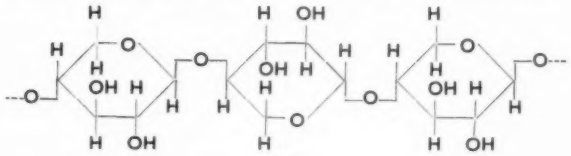


(III)

Erythritol also occurs naturally in lichens and algæ and may be isolated by leaching with alkali. The tetranitrate, prepared by treating erythritol with a mixture of nitric and sulphuric acids, is used medically as a vasodilator. Treatment of erythritol with concentrated hydrochloric acid produces erythritol-1 : 4-dichlorohydrin, which may be converted to the dithiol. Such compounds are of potential pharmacological interest, being analogous to B.A.L. (British Anti-Lewisite, 2 : 3-dimercaptopropanol).

Pentoses and pentosans

Of the 12 theoretically possible carbohydrates with five carbon atoms—pentoses—four occur in nature, while the remainder are laboratory curiosities. The naturally occurring pentoses all have the formula $C_5H_{10}O_5$, and are actually found in nature in a combined state. Xylose and arabinose occur as the polymers xylan and araban, which are both given the general name pentosan. These pentosans are members of the still larger group of carbohydrates known as polysaccharides, all of which are formed from the simple carbohydrates by the elimination of water. Thus xylan is essentially derived from the combination of xylose molecules in a linear form. (IV)

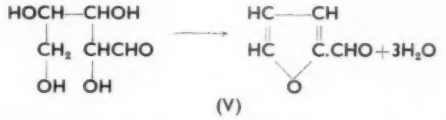


(IV)

To appreciate this spatial formula, one must imagine the molecule as being viewed from above at an angle of 45°; the five carbon atoms at the vertices of the rings have been omitted for the sake of clarity.

Arabinose is also a constituent of certain plant gums, such as gum arabic, where it is associated with pectic materials.

Pentosans are widely distributed, being found in wood (*ca.* 15%), cereal straws, corn cobs (20%), and in the hulls from oats (20%) and rice (10%). Hydrolysis of any of these materials with dilute mineral acids under carefully controlled conditions yields mainly xylose, and the latter can be readily isolated in a pure state. There is virtually no demand for xylose, but if the acid treatment is continued under more stringent conditions, usually under pressure, the xylose and arabinose are degraded to furfural. (V)



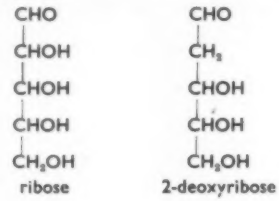
(V)

Furfural is made on a large scale in this way, particularly in the U.S.A., where oat hulls and corn cobs are the favoured raw material. In the West Indies and other sugar producing countries another agricultural residue, sugar cane bagasse (containing *ca.* 15% pentosan), is being utilised for the manufacture of furfural. The pentosans from wood are also a potential raw material; during the processing of wood for the isolation of the cellulose component (see later), the pentosans are preferentially removed by what is essentially a mild acidic hydrolysis. Further treatment of the extracted material with acid produces furfural. This approach has been investigated in detail in the main wood processing countries—U.S.A., Canada, Sweden, etc.—with the object of finding a useful outlet for one of their embarrassing waste products.

Furfural is a valuable chemical intermediate; much is used in the manufacture of synthetic resins, and in recent years large quantities have been consumed in the production of hexamethylenediamine for nylon.

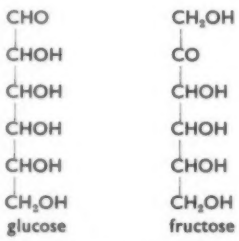
A third member of the pentose group, ribose, is a component of the nucleoproteins of the cytoplasm, and as such is present in all plant and animal cells. Ribose is now available commercially from the hydrolysis of nucleoproteins.[2] A closely related carbohydrate is 2-deoxyribose, which, as its name implies, contains one fewer oxygen atoms than ribose, and can therefore not be formulated as a hydrate of carbon. It is the carbohydrate constituent of a large number of nucleic acids derived

from the cells of animals, plants and bacteria, and is therefore of considerable biochemical importance. 2-Deoxyribose is also produced commercially from glucose by several routes.[3]



Glucose and fructose

It has already been stated that there are no less than 24 carbohydrates having the molecular formula $C_6H_{12}O_6$, but only the two members of this group noted in the heading are worthy of further consideration here. Glucose (also known as dextrose) and fructose (lævulose) are found in the free state in ripe fruits and honey, and glucose is also a normal constituent of blood. Both carbohydrates also occur naturally in the combined state; sucrose is built up from one molecule each of glucose and fructose. Glucose is the sole building unit of certain polysaccharides, such as starch, while inulin, for example, is built up from fructose only. Commercially, glucose is manufactured quite simply by the hydrolysis of starch with dilute mineral acid under pressure, similar hydrolysis of inulin yielding fructose. The latter may also be prepared by the hydrolysis of sucrose; this produces equimolecular amounts of glucose and fructose, a combination known as invert sugar, and the fructose is then isolated by fractional crystallisation. Glucose and fructose, whose formulæ are noted below, are readily interconvertible under the influence of alkalies or enzymes, a fact which is of considerable commercial significance.

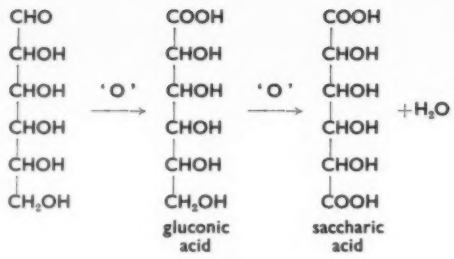


A large quantity of glucose is sold as such for use in the food and pharmaceutical industries, but a greater amount is never actually isolated, and in effect serves as the raw material for a whole range of commercial fermentation processes described later.

Oxidation of glucose

Oxidation of glucose with mild oxidising agents yields gluconic acid, but it is more attractive commercially to carry out this oxidation with atmospheric oxygen with the aid of a micro-organism, and this process is described later. Use of more vigorous oxidising agents results in the initially formed gluconic acid being further oxidised, at the opposite end of the molecule, to a dicarboxylic acid, saccharic acid. (VI)

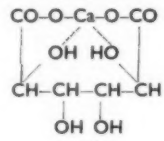
The oxidation is usually carried out with concentrated nitric acid at about 60° to 70°C., and the saccharic acid conveniently isolated as the potassium acid salt.[4] The yield of the latter does not exceed about 50% based



(VI)

on the glucose, and to obtain even this result a considerable excess of nitric acid over the theoretical requirement has to be used. Production of saccharic acid by the catalytic air oxidation of glucose has also been investigated.[5]

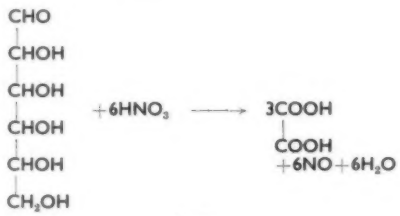
Saccharic acid shows some promise as a sequestering agent, and this stems from its capacity to bind such cations as calcium, iron and copper in ring form through the carboxyl and hydroxyl groups as shown in VII.



(VII)

This water soluble complex is probably analogous to that formed between calcium and ethylenediaminetetraacetic acid (EDTA).[6] In this application it would have to compete with the already established gluconic acid.

One by-product formed in the above oxidation is oxalic acid, and this can be made the main product under even more stringent conditions. The oxidation is carried out with fuming nitric acid in the presence of a small amount of sulphuric acid and traces of ferric sulphate and vanadium pentoxide as catalysts. (VIII)



(VIII)

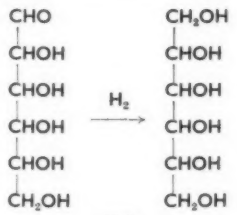
The nitric oxide evolved is absorbed in water and subsequently recovered as nitric acid for re-use, and the yield of oxalic acid is of the order of 70 to 80%.

Fusion of glucose with potassium or sodium hydroxide also affords oxalic acid, but for this process to be worked economically, it is essential to use not glucose itself but waste materials such as sawdust which contain glucose polymers (cellulose) as well as pentosans. Most commercial oxalic acid is now available by other routes (see also later section on fermentation); it is used in laundry work for the removal of stains, in cars for radiator cleaning, and in textile bleaching.

Hydrogenation of glucose

The reduction of glucose to give sorbitol was originally carried out electrolytically in the presence of sodium sulphate, the hydrogen required being produced at the

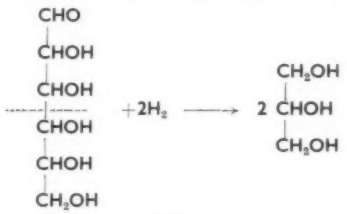
cathode. However, this slow and expensive process is now being replaced by catalytic processes, in which a concentrated aqueous solution of glucose is mixed with a nickel catalyst, and treated with hydrogen in a continuous reactor at about 150°C. and 150 atmospheres. The yield of sorbitol is excellent, exceeding 95%. (IX)



(IX)

This hexahydric alcohol (hexitol) has numerous applications. It competes with other polyols such as glycerol and pentaerythritol in the manufacture of alkyd resins and with the former as a humectant. Esters of sorbitol with fatty acids and other sorbitol derivatives are used in various food products.

By using other catalysts and more stringent reaction conditions, the sorbitol produced initially may undergo hydrogenolysis. In a process[7] developed in the U.S.A. during the second World War the product of hydrogenolysis was glycerol, obtained in good yield. (X)



(X)

At the time, the demand for glycerol in the manufacture of explosives could not be met from traditional sources, but this situation no longer holds. A similar process was used in Germany at the same time to make "glycerogen," a mixture of various polyhydric alcohols rich in glycerol and used as a glycerol substitute.

Hydrogenolysis of glucose as a suspension in methanol with a copper-aluminium catalyst at 250° and high pressure gives propylene glycol, presumably by further reduction of the glycerol formed initially.[8]

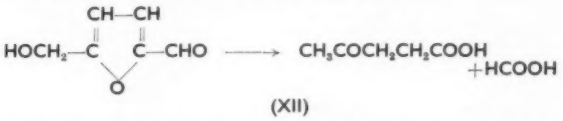
Acidic degradation of glucose and fructose

It will be recalled that the pentoses such as xylose and arabinose are converted to furfural on heating with dilute mineral acid. In a similar way, glucose and fructose are converted to hydroxymethylfurfural. (XI)

(XI)

The reaction proceeds sluggishly with glucose but readily with fructose. From a commercial point of view the poor conversion of glucose is unfortunate, since of course glucose is much more accessible than fructose. This has no doubt held up the commercial exploitation of hydroxymethylfurfural, which might otherwise have attained the industrial significance of its simpler analogue, furfural.

Under more vigorous conditions, that is with the use of more concentrated acids, the hydroxymethylfurfural first formed undergoes further degradation to give lævulinic (lævulic) acid and formic acid. (XII)



(XII)

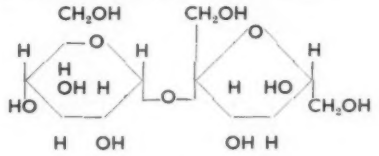
Lævulinic acid is made commercially on a small scale either from starch or sucrose, which act in effect as sources of glucose, and glucose + fructose respectively. The yield of lævulinic acid is much higher from sucrose than from starch, approaching 50%. Lævulinic acid is used in dyeing procedures and the acid and its salts in food products and pharmaceuticals.

Sucrose

Sucrose (cane-sugar, beet sugar) is the most important commercially of all carbohydrates, and in fact is probably produced in larger quantities than any other pure organic compound. It occurs almost universally in plants, but is found in greatest abundance in sugar cane and sugar beet. A very brief description of the method of isolation suffices here : sugar cane is pressed to extract the juice which is then heated with lime to neutralise organic acids and coagulate protein and other impurities. The filtered solution is decolorised with charcoal, and evaporated till the sucrose crystallises, while the dark mother liquor—molasses—is retained for fermentation (see later) or use in animal feed. In the case of sugar beet, the sucrose is extracted with water by the countercurrent principle and isolated as above.

The present world production of sucrose is some 40 million ton/p.a., and virtually the whole of this is used in food. However, if large-scale outlets could be found for sucrose as a chemical raw material, there is no doubt that the production could be doubled or even trebled.

The structure of sucrose is shown in XIII



(XIII)

and the molecule is seen to contain eight hydroxyl groups, all of which are available for the formation of ethers and esters. However, the biggest drawback to the utilisation of sucrose in the chemical industry is the extreme instability towards acids of the glycosidic linkage, that is the oxygen bridge linking the glucose and fructose portions of the molecule. This hydrolysis even takes place on boiling an aqueous solution of sucrose unless care is taken to ensure that the water used has a *p*H of 7 or higher.

At the present time there is some commercial interest in the ethers of sucrose, particularly allyl sucrose. This may be prepared by treating a solution of sucrose in sodium hydroxide with allyl chloride or bromide. The product contains an average of five to six allyl groups per molecule, and on passing oxygen through the heated material it polymerises. This material shows some pro-

mise as a coating for wood, metal and paper.[9] The reaction of sucrose with propylene oxide affords octa-(hydroxypropyl)sucrose, which is potentially useful as a detergent and emulsifying agent.

Treatment of sucrose with an excess of acetic anhydride and sodium acetate yields the fully substituted ester, sucrose octa-acetate. This compound has a quite unusually bitter taste and has been suggested as a denaturant for ethyl alcohol. It may also find use in synthetic resins, but the mixed ester, sucrose acetate-butyrate, is more promising here, since the presence of the butyrate groups leads to greater miscibility with other polymers such as cellulose acetate and polymethyl methacrylate. The low cost of these sucrose esters means that they can be used as extenders in solvent coating formulations.

Of still greater interest are the esters of sucrose with long-chain fatty mono- and di-carboxylic acids. These are now being produced commercially using an ester-exchange process which avoids the acidic conditions generally used in esterification reactions. Sucrose is heated with the methyl ester of the appropriate acid in the presence of an alkaline catalyst and a suitable solvent when the reaction (XIV) takes place:

$$ROH + R'COOCH_3 \longrightarrow ROOCR' + CH_3OH$$

(ROH = Sucrose, $R'COOCH_3$ = methyl ester)

(XIV)

These esters with long-chain acids have many interesting and useful properties. As would be expected from their structure, they have excellent detergent and emulsifying properties, and have a distinct advantage over many of the synthetic detergents in that they are tasteless, edible and readily digested. Many industrial applications of these compounds as detergents, etc. and in food, cosmetic and medicinal products, are being developed.[10]

Sucrose reacts with sodium and potassium in liquid ammonia to give salts (sucrates) analogous to sodium ethoxide from ethyl alcohol. These show some promise as intermediates in the preparation of sucro-chemicals by reaction with, for instance, alkyl and acyl halides yielding ethers and esters.[11]

Lactic acid from sucrose

For many years a considerable effort has been directed towards the evolution of an economical chemical process for the conversion of sucrose to lactic acid. At the present time all the commercial lactic acid is produced by a fermentation process, but it has long been known that the treatment of sucrose with alkali also affords lactic acid. Unfortunately, other acids are also produced in the alkali treatment, and these interfere with the isolation of the desired product. The maximum yield of lactic acid reported[12] is 70%, and this was achieved by treating a concentrated aqueous solution of pure sucrose with calcium oxide at 225° to 240° under pressure. However, it seems likely that an economical process would have to employ crude sucrose—raw cane or beet sugar juice, or molasses—as the raw material and here the yield would probably be lower and the isolation more difficult.

Maltose and lactose

Maltose is built up from two molecules of glucose, and is found in nature in some plants, *e.g.* barley grains. This carbohydrate is also formed as an intermediate in the action of enzymes on starch. Lactose (milk-sugar) is present to the extent of about 5% in the milk of all mammals, and is produced commercially by the evaporation of whey, a by-product from cheese manufacture. On hydrolysis lactose yields equimolecular amounts of its two constituents, glucose and galactose. Lactose is used in the manufacture of antibiotics and in other fermentation processes.

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HOW ORGANON TACKLE STERILE PRODUCT MANUFACTURE (*Continued from page* 519)

stored between coatings has a temperature of 25°-30°C. and a relative humidity of 30-40%. Glazing takes place in a separate room where the air is also conditioned.

Finally, the sugar-coated tablets are left in a room on plates for at least 24 hr. before being poured into tins. This guarantees the maintenance of equilibrium with the conditioned air and therefore also with the air in the counting department of the packing section.

Ointments are also made on this floor. A thermostatically controlled chamber has been installed in which the ointment is kept at the temperature required for tube filling. It is difficult and indeed undesirable in many cases to raise the temperature of an ointment that has once been cooled.

Packing

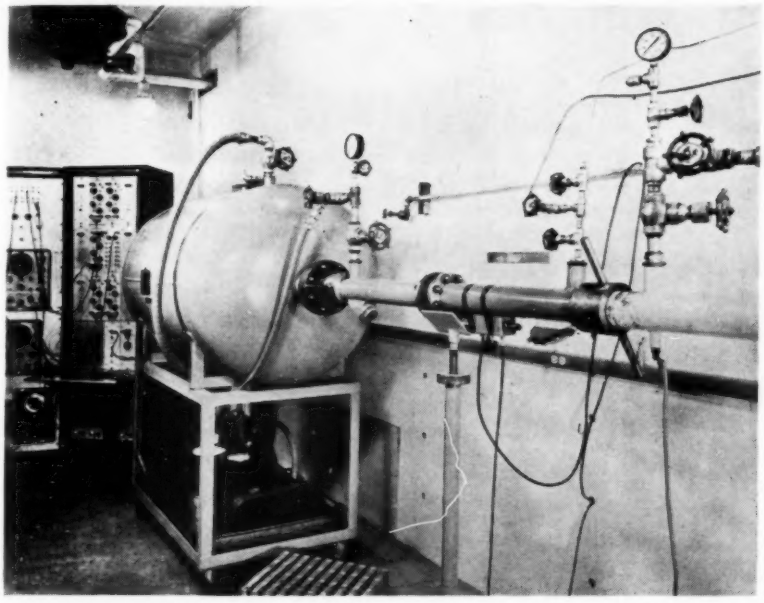
According to the nature of the operations this is divided into two sections:

(1) Counting department, where the tablets are counted into bottles, and
(2) Packing department, where the hermetically sealed bottles, etc., are packed into cartons.

Each section has different air requirements. The counting department requires a relative humidity similar to that of the tableting department; the remaining departments must be supplied with air, of at least 60% relative humidity because of the use of paper and cellophane. The difference in these demands explains why the mechanical operation takes place in two separate departments and why the tablet containers must be hermetically sealed before further work on them can take place.

Great progress has been made recently with hermetically-sealed packing. For tropical packing rubber stoppers of certain quality, provided that they have metal tops, appear to be more satisfactory than paraffin treated cork, and foil strips also are reliable for tablets.

Chemical Reactions Studied with Shock Waves



Components of the shock tube in its special room as shown in this picture are, left to right, the instrument racks, the steel vacuum tank, the 4 ft. high-pressure section of the shock tube itself, and the start (white coloured) of the 14 ft. reaction section. On the floor, foreground, is a bank of condensers.

CHEMISTRY and aerodynamics do not usually go together. But as scientists move ahead on all fronts in their pursuit of knowledge about natural phenomena the recognised barriers dividing the areas of investigation are collapsing.

For some time chemists at the Emeryville, California, laboratories of the Shell Development Company (U.S.A.) have been employing a technique, usually found in aerodynamic research stations for studying hypersonic airflow, to investigate the chemical reactions of gases.

This is the shock tube technique by which a shock wave, travelling at speeds up to 7,000 m.p.h., is used to heat gas molecules in its path to thousands of degrees in millionths of a second. After a predetermined interval the gas molecules are cooled equally rapidly with the result that a chemical reaction can be started and stopped almost instantaneously.

By using this unusual technique Shell scientists hope to shed some light on the many unanswered questions concerning very rapid reactions of gases at high temperature and pressure.

The problem is that the physical processes — mixing, heating, and cooling—tend to obscure the true results of a chemical reaction taking place in the usual apparatus. The shock tube technique overcomes many of these difficulties.

In normal equipment, for example, when a gas A reacts with another gas B a small amount of gas C and a large amount of gas D may be formed. In fact the quantities of C may be so minute that the conclusion is reached that the result of the reaction is the formation of D.

Actually what may have happened is that in the relatively long time required to heat these materials to say 5,000°C., and then cool them, a large amount of D is formed—even though C may be the major product at 5,000°. The only way to find out is to cut the heating and cooling time to as close to nothing as possible.

Two section tube

The shock tube itself is an 18-ft. length of 6-in. steel pipe, divided into two sections. One end is connected to a steel vacuum chamber 3 ft. in diameter, while the other end is closed. An aluminium disc separates the vacuum chamber from the short—or high-pressure—section of the tube. The high-pressure section is filled with a light, inert gas, preferably helium. Another aluminium disc separates this section from the longer reaction section of the tube which contains the gases under study.

To start the reaction, the disc separating the high-pressure chamber from the reaction chamber is ruptured by an electric discharge. This causes a shock wave to travel through the gases in the reaction chamber. Gas molecules in its path are raised thousands of degrees in temperature in millionths of a second.

A second discharge, electronically triggered at a predetermined time by the first one, breaks the disc at the vacuum chamber. The light or driver gas is evacuated and the gas under study is cooled very rapidly and left in the reaction chamber for later chemical analysis.

Design and fabrication of the metal discs were engineering problems in their own right. Rupture must occur exactly the same way every time, at the right time.

Each disc has a circle divided into six equal parts embossed on it. The depth of the embossing determines when the disc will rupture. When a disc bursts it leaves a crown-like shape with six triangular points on it perpendicular to the disc surface. A considerable time was spent determining exact depths and patterns needed and designing equipment to produce these discs quickly and accurately.

THIXOTROPIC DETERGENT

A thixotropic liquid detergent composition consists substantially of a solution of 10 to 25% of an anionic synthetic wetting agent in a preferably aqueous, completely water-soluble organic carrier having a specific weight higher than 1 and consisting of at least two-thirds of a glycol with up to 4 carbon atoms and/or glycerol, which solution has a viscosity of 0·5 to 2·0 Poise, and a dispersed finely divided phosphate which forms water-soluble complexes with calcium. The phosphate particle size should not exceed about 30 μ, and not more than half the phosphate particles should have a size of up to 0·5 μ. The ratio between the phosphate and the wetting agent is 1:1 to 4:1. A corrosion-inhibiting silicate can be incorporated. (Germ. Pat. Appln. 1,074,187.)

Works Manager's Guide to the New Factories Act

By V. A. Broadhurst, B.A.

For the first time for eleven years there is a new Factories Act. Together with the 1937 and 1948 Acts it constitutes the Factories Acts in force—although there are other related Acts such as the Employment of Women and Young Persons Act, 1936. Codes of Special Regulations such as those relating to the use of electricity or the Chemical Works Regulations remain unaffected. The new Act is largely concerned with fire provisions and is characterised by the extensive powers given to the Minister of Labour to make Regulations and, to a lesser extent, to grant exemptions. Important changes are made in the legal requirements for the prevention of gassing accidents in confined spaces and these are summarised in some detail below.

MOST of the Factories Act, 1959, is already in force, but at the time of writing the sections dealing with fire precautions are not—presumably owing to the time needed to set up the necessary administrative machinery.

Painting

Section 1. Cleanliness. There is a change regarding the internal painting of factories. Hitherto painted surfaces had to be repainted with oil paint at least every seven years. In future the manner and frequency of painting will be prescribed by the Minister. More frequent redecoration and a wider choice of paints are likely.

Corrosives and poisons

Section 2. Dangerous substances. Additional requirements are made for fixed vessels, structures, sumps or pits containing any scalding, corrosive or poisonous liquid. Unless they are securely covered, no ladder, stair or gangway shall be placed above, across or inside them unless the ladder, etc., is at least 18 in. wide and securely fenced on both sides to at least 3 ft. and securely fixed. The fencing must be sheet fencing or consist of an upper and lower rail and toe boards. Also, where such vessels, etc., adjoin, either

(*a*) there must be at least 18 in. clear space between them, or
(*b*) the space between must be fenced to at least 3 ft. on both sides, or
(*c*) secure barriers must be placed so as to prevent passage between them.

Lifts

Section 3. Hoists or lifts and lifting machines. The person making the statutory examination shall within 28 days send a copy of the examination report to the District Inspector of Factories whenever it shows that the plant cannot safely continue in use unless certain repairs are carried out immediately or within a specified time.

Effective measures must be taken to warn anyone working above floor level, where he is liable to be struck by an overhead crane or its load, of the approach of the crane. This is in addition to existing requirements, but excludes men whose work is so connected with the crane as to make the warning unnecessary.

Floors

Section 4. Floors, passages and stairs. This section strengthens existing law by requiring that such places shall, as far as reasonably practicable, be kept free from any obstruction and from any substance likely to cause persons to slip.

Workplaces

Section 5. Safe means of access and safe place of employment. A deficiency in existing law is remedied by the requirement that every workplace shall, as far as is reasonably practicable, be made and kept safe for any person working there.

Special precautions must be taken against falls when any person has to work at a place from which he is liable to fall more than 6 ft. 6 in. Hitherto in factories, as distinct from building operations, the distance was 10 ft.

Fumes

Section 6. Dangerous fumes and lack of oxygen. This section replaces section 27 of the Factories Act, 1937, the one which deals with dangerous fumes in confined spaces and which is repealed.

It applies to tanks and other confined spaces in which dangerous fumes are liable to be present to such an extent as to involve risk of persons being overcome—and to danger from lack of oxygen.

Requirements for manholes and other means of egress are unchanged.

No person shall enter or remain in a confined space unless he is wearing a suitable breathing apparatus and has been authorised to enter by a responsible person; also, where practicable, he should wear a belt with a rope attached with a person capable of pulling him out, holding the free end, and keeping watch outside. But these requirements do not apply if the space has been certified by a responsible person as safe for entry without breathing apparatus for a specified period—and the period has not expired. The person in the confined space must have been warned when the period expires.

A space shall not be certified for entry without the use of breathing apparatus unless the following steps have been taken:

(*a*) effective steps to prevent any ingress of dangerous fumes, and
(*b*) any sludge or other deposit liable to give off

dangerous fumes has been removed and the space contains no other material liable to give off fumes, and

(*c*) the space has been adequately ventilated and tested for dangerous fumes and a supply of air adequate for respiration.

In complying with the requirements of the last paragraph, insignificant quantities of such fumes may be ignored.

The occupier shall provide and keep readily available a sufficient supply of approved breathing apparatus, belts and ropes, and suitable reviving apparatus and oxygen. The apparatus, belts and ropes must be properly maintained and examined monthly (unless other intervals are prescribed) by a competent person. Signed reports of examination results must contain prescribed particulars and be kept available for inspection. A sufficient number of persons employed shall be trained and practised in the use of the apparatus mentioned.

The above requirements are superficially similar to the ones already familiar to the chemical industry, but the important changes should be noted as they represent an attempt to remedy defects in the previous Factories Acts. A new idea introduced relates to lack of oxygen, which has not received attention in previous law.

Now, no person shall enter or remain in any confined space in which there is liable to be oxygen deficiency unless:

(*a*) he is wearing suitable apparatus, or

(*b*) the space has been and remains adequately ventilated and a responsible person has tested and certified it as safe for entry without breathing apparatus.

The last part of the section repeats the existing requirement for cooling a boiler furnace or boiler flue before any person enters.

Dust

Section 7. Explosive dust. By slight modification of the main 1937 Act, the application of the relevant section is broadened, but the change is not likely to be of practical significance in a well-run factory.

Boilers

Section 8. Steam boilers. Special Regulations may be made for the manner and frequency of examinations, and meanwhile the Minister may grant certain exemptions from existing requirements.

Fire escapes

Section 9. Exercise by Fire Authorities of functions relating to means of escape in case of fire. The existing functions of the district councils under the principal Act regarding means of escape in case of fire are to be transferred to the Fire Authority constituted by the Fire Services Act, 1947. This section expands upon administrative and similar matters arising.

Section 10. Means of escape in case of fire. This section lays down that no offence is committed by using a factory after applying for a Certificate but before it is either granted or refused. It proceeds to say that the Minister may require plans to accompany an application for a Certificate. If the Fire Authority requires specified alterations before granting a Certificate, it shall specify the time allowed—and if the Certificate is not in fact granted it shall be deemed to have been refused at the expiration of this period specified or such further time as the Authority allows. This is important in the case of legal proceedings.

The Fire Authority shall consult the local authority regarding alterations to any premises outside London (which is subject to special conditions) and shall inform the Factory Inspector of any case in which a Certificate is refused or cancelled. The powers of the Authority shall include that of entry after the Certificate has been issued to ascertain whether there has been a change of conditions making the existing means of escape insufficient.

Fire rules

Section 11. Prevention of fire. Special Regulations may be made regarding the reduction of the risk of fire breaking out in any factory or of fire or its smoke spreading in a factory, and may include requirements for the internal construction of the factory and the material to be used.

Fighting fire

Section 12. Fire fighting. Appropriate means of fighting fire must be provided, maintained and placed so as to be readily available for use. Special Regulations may specify the means to be provided and deal with testing and examination of the means provided as well as the recording of defects found and remedial action taken.

Special Regulations may also be made requiring means to be provided for notifying the fire brigade and for making employees familiar with their use.

Exits and warnings

Section 13. Safety provisions in case of fire. Modifications are made to some existing requirements, *e.g.* the fire exits which have to be marked need not be marked in *red* in future—no one colour is now specified. Existing requirements for fire warnings are largely repeated and new ones are added or, in some cases, substituted. For instance, fire alarms must be capable of being operated without exposing any person to undue risk.

Section 14. Power to extend provisions as to fire warnings and means of escape in case of fire. This power is given to the Minister.

Section 15. Extension to other premises, etc., of regulations under sections 11 and 12. This relates to building operations and other premises not in ordinary language thought of as factories.

Section 16. Testing or examination of fire warnings. These shall be tested or examined every three months at least and whenever a Factory Inspector requires. The frequency and manner of test and examination may be prescribed. Records have to be kept, including details of steps taken to remedy defects.

Section 17. Power of entry of officers of Fire Authorities, etc. The necessary powers are given.

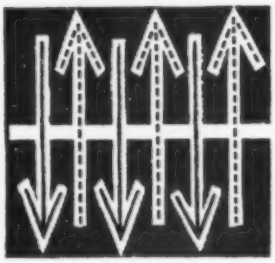
Washing

Section 18. Washing facilities. Facilities shall include clean running hot and cold or warm water.

First aid

Section 19. First aid. Existing requirements for the training of first aid personnel may be extended to small factories now exempt.

(*Continued on page* 542)



TRENDS IN HEAT TRANSFER

Heat transfer systems find many uses in the chemical industry for heating, cooling, evaporation, distillation, crystallisation, etc. This brief survey of current trends in design and construction includes articles on graphite block heat exchangers, plate heat exchangers and a new coiled tube "heat dissipater." Attempts to improve heat transfer with acoustic vibrations are also mentioned. The survey begins with a summary of the new British Standard (3274 : 1960) for shell and tubular heat exchangers.

A MUCH needed British Standard for Shell and tubular heat exchangers for general purposes has at last been introduced specifying minimum requirements. The standard is B.S. 3274 : 1960 and it gives guidance for the mechanical design and construction of this type of heat exchanger, which is widely used for heating, cooling, evaporating and chemical reaction.

The standard covers cylindrical shell and plain tube heat exchangers for general applications within size ranges of 6 in. to 42 in. for nominal shell diameters, of 6 ft. to 16 ft. for tube lengths and of $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. for tube diameters. The following types of heat exchanger are included: fixed tube plate (non-removable tube bundle), U-tube (removable tube bundle) and floating head (removable tube bundle).

Because of the wide range of heat exchangers, more sizes have been listed than are desirable in a standard. The standard itself is divided into four sections. Section I defines the standard and section II deals with the materials of construction and stresses involved. Section III lays down constructional standards and section IV describes inspection, marking, testing and preparation for despatch.

The standard of the Tubular Heat Exchange Manufacturers' Association is widely used, but, like B.S. 2041 (Tubular heat exchangers for use in the petroleum industry), it was based on the requirements of the petroleum industry. The present standard deals more fully with the use of non-ferrous metals for construction and provides data on these materials. The range is extended to lower pressures and lighter types of construction suitable for use when more costly metals are involved. The range of ring flanges is extended, since these are at present the commonly used type in this country.

Pressure classes are as in T.E.M.A. and B.S. 2041, with the addition of Class 20 at 20 p.s.c. The design pressure is related to the basic metal temperature. A reduction in the strength of the metal usually occurs with increase in temperature, and stress tables have been provided for the more commonly used metals to enable the designer to design for the particular working temperature. This method has been preferred to supplying de-rating tables.

B.S. 1500 is used as the basis of mechanical design for these heat exchangers, including the flanges. This specification gives a method for designing flanges, but does not give tables of standard flanges. Such tables for carbon steel ring flanges are incorporated in the present standard, and the standard flange thickness is in accordance with B.S. 1500. The T.E.M.A. thickness is also given, since this standard has been in use for so long, but these flanges would only be used if specified by the purchaser and recommended by the maker. For the other flange dimensions, where B.S. 1500 permits variation, T.E.M.A. dimensions have been used unless there is a good reason for a change, in which case the change is noted.

Tables for welding-neck flanges (from T.E.M.A. tables) are also included, since although they are at present used in a minority of cases, their use is increasing.

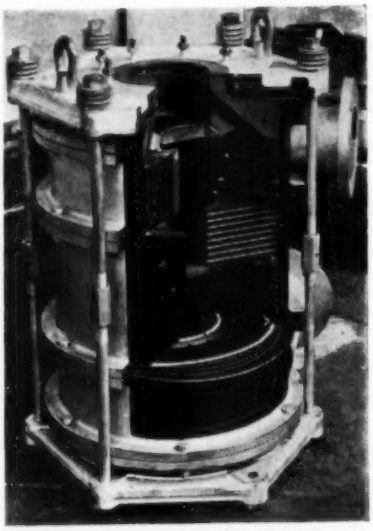
Graphite Heat Exchangers

By A. Hilliard*

A primary requisite for plant in the pharmaceutical and fine chemicals industries is inertness. Graphite, which is unique in its combination of excellent thermal conductivity with highly versatile resistance to chemical attack, is well suited to satisfy this condition. It also has the advantage of forming no solid compounds and, therefore, avoids the nuisance of chemical fouling.

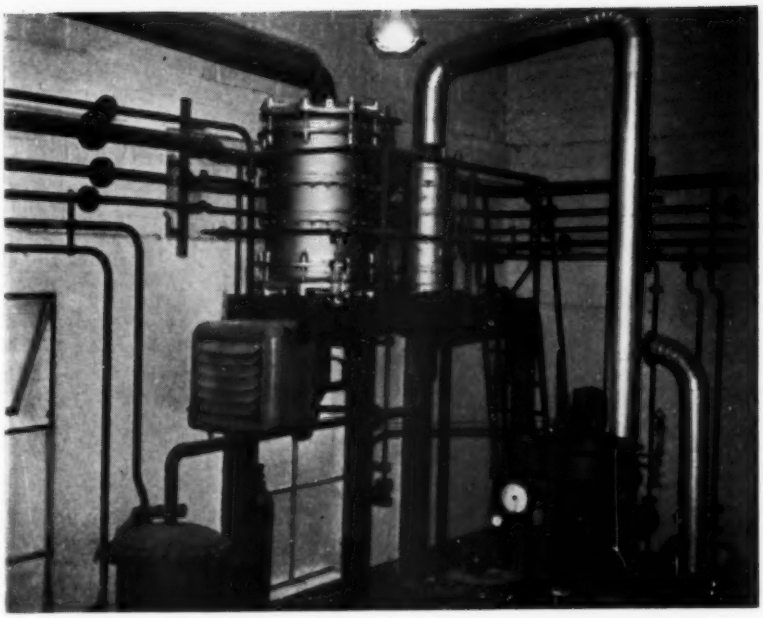
Unlike many metals, graphite does not depend for its inertness upon a protective surface film. In the majority of refractory metals, the protective film is spontaneously regenerated if it is detached through differential expansion or for other reasons, which may result in some contamination of the fluids and erosion of the constructional metal. Certain constituents of alloy metals may be leached out by process fluids, and may necessitate subsequent purification by precipitation or other methods. Graphite equipment is, therefore, particularly useful in processes where even trace contamination is inadmissible.

To exploit fully the chemical inertness of graphite it is important to avoid cemented joints in the assembly. The choice of cements for graphite is limited to a narrow range



Polybloc GM8 assembly with part of the shell and blocks cut away to show internal construction.

* Technical Adviser to Société Le Carbone-Lorraine.



Polybloc plant for condensation of mixtures of solvents and steam, comprising a super model of three blocks and a standard of eight blocks.

of resins, by a multiplicity of requirements, including chemical inertness identical with that of graphite, temperature resistance, mechanical strength, and ability to bind. Cements may be subject to deterioration through ageing and other factors and may consequently develop leaks. Whereas constructional graphite is usually impermeabilised by impregnation, impregnants do not require mechanical strength or ability to bind. They can be selected from a much wider range of suitable materials, and in the absence of cemented joints, graphite can be made impermeable by the thermal deposition of carbon in the pores. Reliably fluid-tight plant is particularly important for certain biochemical processes, *e.g.* leakage of cooling water to the process fluid could set up bacterial growth.

Graphite cannot be welded or sweated together, and the alternative to cementing, for assembly is to use detachable gaskets. The chemical inertness of gasket materials is generally inversely proportionate to their elasticity. To permit the use of gasket materials having comparable inertness with that of graphite (Fluon, Teflon, etc.), it is important to use O-rings, because these give readily fluid-tight joints.

Graphite is highly anisotropic and its physical as well as mechanical characteristics differ fundamentally from those of isotropic metals. It is, therefore, important not to superimpose graphite on constructional systems which were developed for the latter, but to design around the material properties of graphite alone.

A constructional method which satisfies these requirements is the Polybloc System. This is based on cylindrical graphite blocks having a central hole. One set of heat exchange passages (axial) is parallel to the axis of the block. The other set (radial passages) connects the central hole with the outer periphery of the block. The blocks are assembled in a column, to produce whatever heat exchange area may be required. They are held together exclusively under compression by external spring loaded tie-rods. The process fluid circulates through the axial passages and contacts only graphite and correspondingly inert gaskets. The service fluid circulates through the radial passages, and is contained by an outer shell around the column of blocks.

This assembly, which is exclusively under compression, exploits the good compressive strength of graphite, and avoids the effects of low tensile and flexural strength. The robustness is therefore comparable with that of plant made from metal. All passages are so short that they can be made by direct drilling of solid blocks. This permits the positioning of the two sets of heat exchange passages so that any preferred anisotropic crystal orientation is exploited for highest "effective" thermal conductivity. The ultra-short passages introduce also an important "end effect" of fluid flow. Consequently high turbulence, inducing correspondingly increased heat exchange efficiency and important anti-fouling effect, is obtained at slow flow rates and low pressure drop. The cylindrical shape of the blocks permits the use of highly inert detachable gaskets (usually Fluon), which introduces versatility.

Examples of Polybloc plant in the pharmaceutical industry have been discussed[1] with regard to their use in the manufacture of the tranquilliser *Ultran*, the analgesic *Darvon* and the hypnotic *Valmid*. These condensers recover solvent or provide continuous condensation during reaction. Examples are also included of processes involving the treatment of ether, alcohol, acetone, acetic anhydride, acetic acid, hydrochloric acid, chlorobenzene, benzene and naphtha.

A particularly interesting feature is the statement that Polyblocs have a heat exchange efficiency three times greater than that of the previously used tubular units, namely that each one does the job of a conventional tubular condenser three times its size.

The application of this constructional method is not limited to these examples. It is generally applicable to the construction from non-metallic, anisotropic materials, of heat exchangers, absorbers, evaporators, concentrators, condensers, strippers, etc.

Details of the Polybloc System have been discussed in a number of prior publications and patents as follows:

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2. Le Carbone-Lorraine and A. Hilliard, B.P. 756,327; 756,420; 797,544; 808,728 and B.P. Appn. No. 8217/59.
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4. A. Hilliard, "Some Recent Developments in Graphite Heat Exchangers and Similar Equipment." Carbon and Graphite Conference, Society of Chemical Industry, London, September 1957.
5. *Idem*, "The Polybloc System of Construction for Anisotropic Materials," Waverley Research Award 1960.
6. *Idem*, "Application of the Polybloc System to the Construction of Absorbers," presented Swedish Royal Technological Institute, Stockholm, October 1959; Reprinted *Brit. Chem. Eng.*, March 1960.

Plate Heat Exchangers

By R. Fuller, A.M.I.MECH.E.

The plate heat exchangers which are considered here are of two classes—the flat plate and the spiral plate types. Both are of specialised design.

Flat plate

The flat plate type was developed for use in the dairy industry, but the very features and advantages which made it ideal in this field have been recognised on a wider scale for use in the chemical industry.

A typical plate heat exchanger of this type is shown in Fig. 1. It consists of a frame, similar to the well-known filter press, enclosing a group of pressed thin gauge metal heat transferring plates usually made of stainless steel, these being sealed around their edges by synthetic rubber gaskets. The normal frame design consists of a fixed head and end support, connected by bars at their upper and lower ends, whilst a third main member, the follower, is free to move along these bars and clamp the heat transfer plates between it and the head. The head and follower are provided with bushes to permit entry and exit of the liquids between which heat is to be transferred. Auxiliary headers, to allow liquids to enter and leave at intermediate points can be inserted between the heat transfer plates when multiple heating and cooling duties have to be carried out in the same frame.

Plates are arranged in parallel with each other in groups known as "passes," the number in each pass being dependent upon the volumes of liquids being handled. Several of these passes, in series with each other, may be needed according to the severity of the thermal duty. A characteristic arrangement for a simple cooling or heating duty is shown in Fig. 2.

Certain operational advantages follow from this form of construction, the most important being:

(*a*) ease of mechanical cleaning of both sides of the heating surfaces,
(*b*) high heat transfer rates due to thin film flow,
(*c*) ease of extension of duty should this become necessary.

In addition, this class of machine is outstanding for its high degree of bacteriological cleanliness, which is very desirable in the pharmaceutical industry.

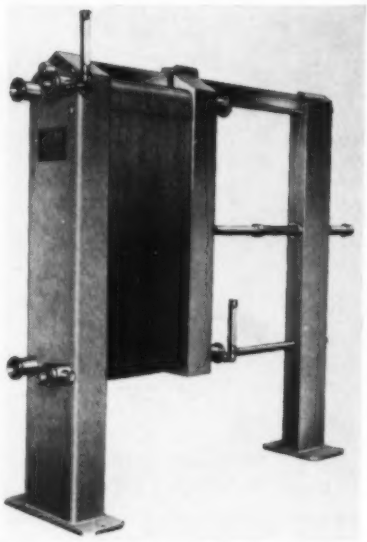

Fig. 1. Flat plate heat exchanger showing the frame enclosing a group of pressed thin gauge metal heat transferring plates.

Spiral plate

The spiral heat exchanger is of very different design and construction. It is in fact one continuous sheet formed into a double spiral, one within the other, by winding on a special type of mandrel. Three basic forms of the spiral heat exchanger are available, as shown in Fig. 3. The choice of these forms depends on the duty which it is required to perform.

This spiral type of unit can be used as well for condensing duties as for straight liquid/liquid heat exchange, and this distinguishes it from the flat plate design which is, except in certain circumstances, considered unsuitable for general vapour/liquid applications.

An advantage of the spiral heat exchanger, particularly on liquid/liquid duties, is the completely counter-current nature of the flow pattern which, together with the high heat transfer coefficients which are achieved, makes this an extremely efficient and compact piece of apparatus.

The spiral body is closed at both ends by covers when the unit is in operation. These can be removed for cleaning, and give access to both sides of the heat transfer surface.

Application

Both types of heat exchanger have been extensively used in the fine chemical and pharmaceutical industries for a variety of purposes—one frequent use is in solvent recovery plants, particularly in the antibiotics industry.

At one stage in its production penicillin is extracted by means of solvents which may be amyl or butyl acetate, or methyl *iso*-butyl ketone. The recovery of these solvents contributes to the economy of the antibiotic manufacturing process. Fig. 4 shows a spiral heat exchanger installed for pre-heating feed to a solvent recovery column using, as a heating medium, the hot effluent from the bottom of the still. By doing this the steam load on the column is appreciably reduced. The solvent being recovered in this case is methyl *iso*-butyl ketone.

Both the plate heat exchanger and the spiral heat exchanger have been used for similar processes, although the spiral heat exchanger has a rather wider field of application due to the effects of some solvents on the synthetic rubber gaskets of the flat plate type heat exchanger.

In the manufacture of antibiotics a widely used growth medium is corn steep liquor. Sterilisation of this material has been carried out by

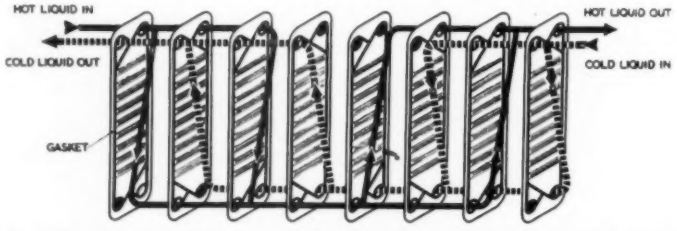

Fig. 2. Plate heat exchanger. A characteristic arrangement for a simple cooling or heating duty.

both these heat exchangers. This processing of corn steep liquor occurs not only at the antibiotic factory itself but also earlier in the chain of production at the starch manufacturers' where it is frequently pre-heated prior to concentration in multiple effect evaporators.

The plate heat exchanger has been used very successfully for the pasteurisation of gelatine liquors, and a particularly outstanding example of this has been operating in Belgium for the last ten years. In such a plant full use is made of the ability of the plate heat exchanger to achieve multiple duties within one frame, for the system that is employed is one that needs a three-section heat exchanger.

In the first section the raw gelatine is partially heated by heat transfer from the hot pasteurised gelatine which is returning to be cooled—about 75% of the total heat load is accomplished in this manner. In the second section the preheated raw feed is finally heated to pasteurisation temperature using recirculating hot water as a heating medium. After heating to this temperature the hot gelatine liquor flows through a holding tube where its passage is delayed for a predetermined time to complete the pasteurisation process.

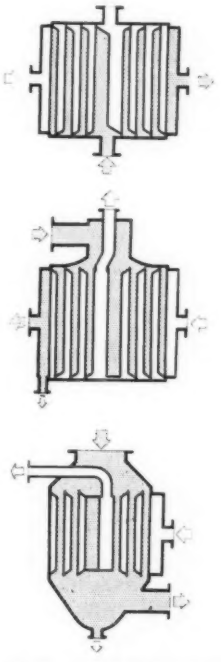

Fig. 3. Three basic forms of the spiral plate heat exchanger.

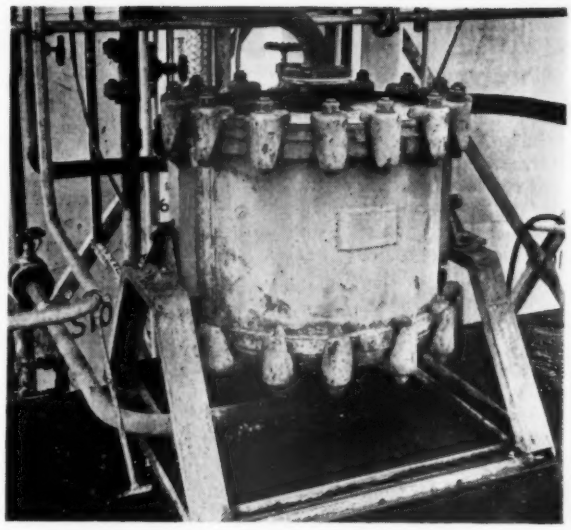

Fig. 4. A spiral heat exchanger installed for pre-heating feed to a solvent recovery column in an antibiotic plant. The solvent being recovered is methyl *iso*-butyl ketone.

It is then returned to the first section to carry out the pre-heating referred to above, ultimately passing to the third section where final cooling of this pre-cooled material is carried out using cold water as a cooling medium.

In a plant of this type it is important to control the flow rate of the gelatine liquor and the temperature of the outgoing liquor so that both the variables involved in bacteriological destruction, temperature and time, are satisfied.

Most modern techniques for the manufacture of perfumes and flavourings employ synthesised aromatics. Almost all perfumery synthetics and isolates are composed of alcohols and their esters, aldehydes, ethers and ketones, or certain acids and their esters, lactones and phenols. A few nitrogenous compounds are also used. Among the chemicals used for the production of perfumes and cosmetics can be included benzene, acetic anhydride, acetaldehyde, glycols, isopropyl alcohols, ethyl and methyl-alcohols, amyl and butyl acetates, and all of these have been successfully handled, particularly by the spiral heat exchanger which lends itself admirably to heating, cooling and condensation of them.

A problem that sometimes occurs in photographic processing laboratories is the removal of heat picked up by developing solution and both of these heat exchangers have been used with success. Temperature control on these solutions, particularly for colour processing, must be extremely accurate, and the small liquid hold-up of both of these units enables control response to be as rapid as possible by minimising plant lag. Plate heat exchangers installed in a well-known colour film processing laboratory in this country have been operating successfully for several years now.

The author thanks the directors of the A.P.V. Co. Ltd. for permission to publish this article.

Vibrations may Improve Heat Transfer

The Southwest Research Institute, U.S.A., has been investigating the effect of acoustic vibrations on salt water conversion.

The experimental unit consists of a 1 in. diameter pipe 37 in. long, installed inside a 3 in. pipe. Water flows continuously through the annular passage to a cooling coil and back; electricity flowing through the pipe wall heats the 1 in. pipe. An oscillator and amplifier power a vibrator which is fastened by a short rod to the 1 in. pipe. The vibrator delivers energy to the pipe creating turbulence in the water film.

Results of the effects of acoustical vibrations on waterside heat transfer coefficients over a Reynolds number range of 540 to 20,000 at various frequencies and amplitudes showed that the lower the Reynolds number the more effective the vibrations; and at all Reynolds numbers vibration helped heat transfer.

Three other arrangements have

been studied to improve heat transfer. These are: transverse vibrations impressed directly into the water stream flowing inside a heated tube; longitudinal vibration of the containing pipe with no vibration impressed into the water stream; and transverse vibrations of the containing pipe with no vibration impressed into the water stream. None of these were found to improve heat transfer by more than 10%.

Coiled Tube Heat Exchanger

The Heat Dissipater is a compact heat exchanger with a capacity of 10,000 B.T.U./hr. It was developed for cooling systems for mechanical shaft seals operating at high temperatures, but it can be used for other purposes.

The units can be mounted in series or in parallel if the rate of flow and the required temperature drop exceed the capacity of a single unit.

The product is circulated through a seamless stainless steel tube element which is encased in a stainless steel shell. The coolant (normally water) circulates round the element within the shell. The standard unit is made from stainless steel. It is suitable for pressures up to 2,000 p.s.i. for the product and 150 p.s.i. for the coolant.

The Heat Dissipater consists of two main parts: the element, and the shell and cap.

The element is a coil of seamless stainless steel tube (pressure tested to 3,000 p.s.i.) silver soldered into a stainless steel end plate. The product does not come into contact with the silver solder. Connection to the exchanger is through olive unions; stainless steel connections are used for the product, and cadmium plated mild steel for the coolant.

The shell is a seamless stainless steel tube (pressure tested to 200 p.s.i.) in which the stainless steel cap is sealed by an O-ring.

The heat dissipater will normally be installed with the pipe connections upwards, since the trapped air will then flow to the open end of the pipe. It will also operate satisfactorily in the inverted position, or within 10 deg. of the horizontal, provided that all airlocks are eliminated before starting up.

Rates of flow range from 20 to 120 gal./hr. The unit itself is 15 in. in length and $3\frac{3}{16}$ in. diameter. The Heat Dissipater is made by Crane Packing Ltd.

Pressure Packed

RECENT estimates indicate that the 1961 potential for aerosol-packaged pharmaceuticals in the United States is between 200-300 million dollars. Of this volume, no more than 5% is actually realised. However, it is evident that these markets are at the nucleus of a major growth period as some authorities predict that many if not most externally applied products, as well as inhalants, will eventually be dispensed in the form of aerosols.

Indicative of this expected trend is the institution by several pharmacists' schools, among them Philadelphia College of Pharmacy and Science, of instructional courses in the fields of formulating and packaging of aerosol preparations. These colleges anticipate the use of aerosols as prescription dosage forms which will be compounded by the pharmacist.

Problems

Despite their great potential for aerosol sales, pharmaceuticals have lagged far behind other products—notably insecticides, cosmetics, and paints—in adopting pressure packaging. Several special problems have been responsible for this. Among them are the requirements of filing a New Drug Application for all aerosols administered as inhalants, the reluctance of the major pharmaceutical houses to employ aerosols for any but speciality applications, the higher cost of aerosol-packaged products, and the shortage of specific technical information, such as the solubility and stability of various drugs in propellants and the effect of particle size of the spray. Thus, it is interesting to note that the most widely quoted information on particle size penetration in nasal sprays is based on experimental work carried out in 1936-40.

Many of these problems are being overcome. Extensive research carried on in pharmaceutical laboratories is directed toward providing needed fundamental and clinical information and toward expanding the field for aerosol application of pharmaceuticals, thus removing from pressure-packaged products their purely speciality character. The fear of the somewhat higher prices for aerosol-packaged products is being overcome by the realisation that this is more than offset by the immediate and sustained relief often obtained and by the advantages of accurate metering, hermetic and tamper-proof sealing which are offered by pressure packaging.

Proprietary drugs account for about one-third of the 200-300 million dollar potential for aerosol-packaged pharmaceuticals. Yet, proprietaries make up the overwhelming majority of pharmaceutical products now being marketed in this form at the present time. A partial list of items in this category includes cold remedies, burn sprays, athlete's foot medication, spray bandages, poison ivy remedies, etc.

The development of ethical drugs in aerosol dispensers has been much slower despite the larger potential in this field. Philadelphia College of Pharmacy's Dr. Martin Barr estimated that $130 million worth of ethical drugs marketed in the United States during 1960 could potentially be sold in the form of aerosols. Of this total, topical pharmaceuticals make up $30 million, inhalants account for $26 million, while rectal and vaginal preparations total $18 million. Among ethical pharmaceuticals now on the market in the form of aerosols, topical drugs are in first position. Included in this group are topical antiseptics, antibiotics, anæsthetics, and analgesics.

Second in importance, and probably the fastest-growing group of pressure-packed ethical drugs, are the group employed in ear, nose, and throat therapy. In this field, inhalators have, of course, long been employed. However, conventional atomisers have the disadvantages that they lack control over the dosage introduced into the nasal and bronchial passage.

Here, aerosol application is possible through metered valves and with controlled size of spray particles which assures uniformity of dosage and penetration of the medication to the desired area (the percentage of spray retained by the trachea, the bronchi, the bronchioles, and the alveolar ducts depends, above all, on particle size).

Inhalants

The large potential for aerosol

Pharmaceuticals

By P. W. Sherwood

In the United States the pharmaceutical industry is beginning to use the aerosol or pressure pack for a wide range of topical preparations. Although this form of dispensing is expensive, it offers technical and therapeutic advantages. However, a great deal more technical information is needed for the fuller development of this form of packaging.

inhalants can be gauged if we consider that there are, in the United States alone, an estimated 2·5 million bronchial asthma sufferers for whom 5 million prescriptions are being written annually. Treatment includes parenteral, topical and oral therapy with 90% of the prescriptions written for oral products. More generally, the number of patients exhibiting some allergy is estimated at 16 million, many of whom will eventually benefit from aerosol application of medicinal products.

In the field of inhalants, only very little work has been done on the use of aerosols in the ear but this, too, constitutes a potentially very attractive area.

Eight possibilities

Beyond these areas, which are already clearly discernible, a number of diseases are potentially susceptible to therapy by aerosol-type medication. S. B. Prussin has recently suggested eight fields in which research concerning the use of pressure-packed ethical drugs may be advantageously concentrated. These include: (1) treatment of lung cancer by radioactive drugs; (2) aerosol therapy with insulin and other antidiabetic drugs; (3) treatment of asthma and chronic bronchitis by aerosol inhalation of mucolytic enzymes; (4) application of cerebral stimulants and mood elevators; (5) inhalation of living attenuated organisms to provide immunity against tuberculosis; (6) aerosol administration of sera which are now applied by hypodermic syringe; (7) new drugs against bronchial asthma and hay fever; (8) aerosol inhalation of allergens to provide immunity to various allergies.

Outside the fields of topical and inhalant application of ethical drugs, a more limited potential is seen for aerosol dispensing in the area of rectal and vaginal preparations. This may cover both local treatment

An antibiotic powder spray as held for use, and the package assembly made by the Metal Box Co. Ltd. From top to bottom are the aluminium screw cap, a cardboard ring, the applicator wrapped in a heat-sealed Diothene bag, the protective cap, the aerosol and a foam rubber cushion.

(anti-pruritics, anæsthetics, anti-infectives) and therapy by systemic absorption through the rectal or vaginal surfaces (hormones, barbiturates, bronchodilators). Much research work remains to be done in this field.

Dental use of pharmaceuticals in the form of aerosols is receiving serious attention. Included are means for oral prophylaxis, tooth stain removers and polishers, local anæsthetics, antibacterials, emollients, etc.

Three advantages

The optimistic outlook which is seen for the development of aerosol-formulated pharmaceuticals is based principally on three advantages which are unique for this form of dispensing:

(1) *Availability of metered valves.* This assures consumer economy and is particularly important for drugs which must be used in carefully measured amounts. Related to this advantage is the ability of properly designed pressure-pack valves to control spray pattern and particle size.

(2) *Gas-tight package.* Because air and contaminants are kept out of contact with the medication, sterility and a long effective life are assured for pressure-packed drugs. At the same time, the package is tamper-proof; there is essentially no danger that foreign components are introduced once the container leaves the packager's control.

(3) *Ease of application.* Aerosol-packed medication can be applied quickly and readily even to inaccessible and hairy areas of the body. Application to painful areas is more comfortable because contact with a solid applicator is not needed.

For the manufacturer, use of aerosol packs creates new problems. Aside from the considerations which always apply in the marketing of drugs (therapeutic effectiveness, stability, toxicity, side effects), attention must be given to a number of new factors, notably the following: compatibility of the drug with the propellant (including effect on clinical performance and stability), optimum type of packaging (pressure, choice and volume of propellant, size of package), selection of valve (type of metering, dosage, spray pattern), type of formulation (solution or suspension of the drug, use of additives). Another important point is that of the actual filler's role in pharmaceutical aerosols. The contract filler must have specialised equipment such as refrigeration plant, driers, filters, screens, etc. Necessarily there must be adequate quality control facilities including pre-production inspection, process control, laboratory control and finished product inspection.

Some of these factors are outside the pharmaceutical manufacturer's normal field of experience. However, considerable information and assistance can be obtained by discussion and collaboration with producers of the aerosol package equipment and of the various types of propellants.

DETERGENTS and Detergency

By Leon Raphael, M.SC., F.R.I.C.

U.S. detergent sales ● Alkylate sulphonation process ● Liquid detergents ● Nonionics ● Detergent bars ● Sewage ● Isotopes ● Detergents as bactericides ● Petrol additive ● Packing for chromatograph columns ● Sequestering agent ● Silicates

Seventy-five per cent

SYNTHETIC detergents continue to displace soap and now form 75% of the total detergent and soap market in the United States.

Table 1 shows the continued growth of syndets in that country over the past few years.

Table 1

	Million lb.		*% Syndets*
	Syndets	*Soap*	*of total*
1956	2690	1285	68
1957	2916	1189	71
1958	2951	1138	72
1959	3080	1044	75

The marked increase in 1959 was assisted by price reductions in the most important active ingredients—alkyl aryl sulphonates, alkyl phenol type nonionics, amines and amide condensates. Although the price of benzene has remained stable, alkylate has dropped in price and fatty alcohol sulphates are shortly to be made available from petroleum sources. The saturated long chain alcohols (C_{12}—C_{16}) are being made with the aid of tri-ethyl aluminium, produced from ethylene, hydrogen and aluminium. It reacts with ethylene as follows:

$$Et_3Al + (n-3)\,C_2H_4 \longrightarrow Et_nAl$$

The product is oxidised by air to Et_nOAl which on hydrolysis produces a saturated alcohol and aluminium oxide. Unsaturated alcohols can be produced by high-pressure hydrogenolysis of fatty esters.

Alkylate sulphonation process

A new development in sulphonation of alkylate[1] employs a carbonate which forms a complex with SO_3 which assists the main reaction giving a product of lighter colour. Again, the reaction of SO_2 and oxygen with hydrocarbons under the influence of γ-rays produces sulphonic acids. N-acyl amino alkane sulphonates promote better foaming properties in the presence of straight chain alcohol sulphates or alkyl aryl sulphonates. Nonionics have continued to grow while alkyl aryl sulphonates have reduced their share of the market to about 50%. The low foaming nonionics, such as tall oil condensates, were favoured in the past for use in mechanical dish washers of the tumbler type, but now agitator machines are becoming popular people are preferring high foaming detergents.

Liquid detergents

The principal outlet for nonionics is in liquid detergents,[1] the sales of which rose by 30% in 1959 and now form 20% of the total detergent and soap sales. Progress has been made in packaging, metal cans now being of a similar cost to glass bottles, although the glass bottle is still preferred by housewives. It looks cleaner and more hygienic and it is nice to see the product. Recently a pressure packed detergent has been marketed in a plastic-coated glass bottle.

The heavy duty liquid detergents are still feeling their way and are meeting problems in formulation. Alkyl aryl sulphonates can only be used in low concentrations in liquid products. A new ingredient is disulphonated dodecyl diphenyl oxide which might prove more suitable. Clouding of the solution can be prevented by addition of sodium toluene sulphonate. The potassium salts are more soluble than sodium salts, and potassium dodecyl benzene sulphonate allows the incorporation of many more ingredients in the solution, particularly large amounts of potassium pyrophosphate which promotes detergency.

Sulphated ethylene oxide derivatives are useful as foam promoters in liquid detergents and the presence of lauric diethanolamide (LDEA) will solubilise sodium tripolyphosphate. Sodium silicate, a corrosion inhibitor, can be solubilised by addition of lauryl glyceryl ether sulphonate. A thixotropic product has been marketed which gels on standing and is pourable on shaking. It is believed to contain glycols and glycerine.

Nonionics

Tall oil derivatives have produced low-priced nonionics but reduction of the tall oil acids to alcohols and then reacting with ethylene oxide produced the more stable ethers. This additional step had made the products more expensive, but they are better detergents. At one time it was thought that condensates of ethylene oxide with mercaptans were limited in use and could not be included with peroxides. However, the sulphoxides resulting from their interaction are claimed to be good detergents for wool and nylon.

A new builder for use with nonionics and improving detergent properties is a styrene-maleic acid copolymer together with organic amides. Drip-dry fabrics are produced by impregnation with certain resins. Nonionics, it is claimed, improve the process of impregnation. Those of the Lissapol NX type do not promote rewetting and therefore do not interfere with the effect of resins in resisting spotting and staining of fabrics.

Detergent bars

While detergent bars are making slow but steady progress in the United States and in Europe, the combination bar seems to be receiv-

ing more attention. Detergent bars can be produced on conventional soap bar machines by combining sodium α-sulphonated straight chain fatty acids with the corresponding ammonium soaps. Another suitable composition results from the condensation of a fatty acid with a hydroxy ethyl sulphonate. Using 15% nonionic of the nonyl phenol/ethylene oxide type with a potassium soap, a gel form is produced resistant to hard water.

Interference with sewage

The Institute of Sewage Purification held a conference last June to survey progress in solving the problem of the interference of syndets with sewage-treatment plants.[8] Alkyl aryl sulphonates were considered to be the greatest nuisance, causing copious foam which was very stable. They are not readily decomposed by oxidation processes and themselves inhibit the oxygenation of sewage. It was also thought that they killed off fish by reducing the oxygen intake of the water. Until recently the alkyl aryl sulphonates were made by alkylation of benzene with propylene tetramer, followed by sulphonation. Such a compound contains a highly branched alkyl chain and this was considered to produce more stable foams. Straight chain alkylate is more readily decomposed and the manufacturers of detergent base in the U.K. agreed to change over to this type for large-scale experimentation.

After nearly a year, the trials showed that the effluents contained less surface active material, it being reduced from 4 p.p.m. representing 68% removal, when the old type was used, to less than 1 p.p.m. or 93% removal, after a 6 hr. retention period. Foaming was markedly reduced. When 3 p.p.m. of a packaged detergent such as Manoxol OT was dissolved in well-oxygenated water, 50% of the trout in the water were killed in 12 weeks. However, after biological treatment of sewage, it was found that the surface activity remaining in the effluent was less toxic to fish and was not a serious danger in this country. One other factor observed was that after 20 days the old type detergent was not further decomposed by aeration, while the new type of product was further reduced in concentration to 0·5 p.p.m. representing 96% removal.

The two types of alkylate can be distinguished analytically by studying the infra-red spectra of their sulphonates. The new material is less branched than the propylene tetramer type and is a mixture of isomers and homologues. As both types of alkyl aryl sulphonate were present in the sewage during the trial, it was necessary to determine the relative proportions of each. The sulphonates show small but significant differences in their infra-red spectra and by measuring the ratio of absorption at 1406 and 1396 cm^{-1}, the proportions of the two types of detergent could be estimated to within 5% accuracy.

Isotopes

The mechanism of detergent action has been studied by several radioactive tracer techniques. Alkyl aryl sulphonates can be tagged with radioactive sulphur S^{35} which showed the degree of sorption on clean and soiled cotton. The surfactant concentrated at the air/solution interface disperses the air from the fabric and the soil, so increasing the wetting of both. The alkyl aryl sulphate is sorbed on soil as the latter clings to the fibre. Using sodium pyrophosphates tagged with P^{32}, the effect of the phosphate was shown in removing multivalent positive ions from the soil. Surfactant sorbed on soil acts as a deflocculating agent and hinders redeposition.

Other studies with soot tagged with C^{14} to observe dirt removal gave erratic results. Visual tests did not always agree with those shown by residual radioactivity.[2] Fatty acids tagged with C^{14} have been used to observe metal cleaning efficiency by detergents and to study the effect of sequestering agents. The removal of bacteria from dishes has been followed by feeding the micro-organisms with P^{32}.

The stability of emulsions can be evaluated by tagging one component and observing the gradient of radioactivity throughout the mixture from the top to the bottom, as a measure of homogeneity, so that the separation can be more readily followed.

Detergents as bactericides

An interesting feature about the use of detergents as bactericides was recently reported.[3] *Carymerius dollfusi* is a trematode parasite frequently occurring in sheep and cattle in Madagascar. The usual insecticides such as DDT or BHC were found to be ineffective. It was thought that a wetting agent would help penetration of the insecticide and so investigation began on formulation. Difficulties arose in the use of Teepol and results varied with different insecticides. For example, Lindane (γ-BHC), was not as effective as the mixture of isomers, the reverse of what was expected. The γ-isomer is considered to be the only effective constituent of the mixture used in commercial BHC. When Teepol was used alone, however, it was surprisingly successful, one part in 1,000 controlling the parasite within 2 hr. A silicone based anti-foaming agent was incorporated, giving very good results.

Petrol additive

A new detergent has been brought on to the American market for use in car engine carburettors.[4] It is sold as Centrol S/41/K and is known to be a modified phosphatide made from lecithin which is derived from soya beans. Originally, it was developed to prevent or remove varnish deposits collecting on the throttle plate. These deposits can cause rough idling as well as poor acceleration and mileage. They are produced by the fumes of other cars during idling in traffic jams. The addition of 50 p.p.m. of *Centrol* S/41/K to petrol results in a cleaner carburettor, thus saving repair bills and giving reduced consumption of petrol. In addition, it is a good anti-icing compound and a mild rust-inhibitor. It is recommended for use in conjuction with tricresyl phosphate or cresyl diphenyl phosphate, which are already added to petrol blends to prevent surface ignition and fouling of sparking plugs. When the relative humidity is greater than 85% icing can present a problem even at temperatures around 35° to 47°F. Rapid expansion results in cooling of the moist gases entering the carburettor, so producing ice which blocks the air-flow to the engine, causing stalling during idling. *Centrol* S/41/K is sold as an 11% solution in a hydrocarbon solvent.

Packing for chromatograph columns

One of the most successful tools of analytical chemistry is gas-liquid chromatography. The problem besetting any analysis is the choice of a suitable packing material for the column with the right adsorptive properties to effect the most efficient separation. Alkyl aryl sulphonate-based detergents have been successfully used for this purpose.[5] They have the advantage of cheapness and

provide the right particle size, but they have the disadvantage of hygroscopicity due to the inorganic salts present and must therefore be sealed from the atmosphere. They are stable at high temperatures and have the necessary polar character, but composition needs to be standardised. The particle size is suitable for columns of high efficiency and low pressure drop.

Sequestering agent

Gluconic acid was first isolated in 1878 by Boutroux during lactic acid fermentation, but was not commercially available until 50 years later. It is now produced by fermentative oxidation of glucose, the aldehyde group —CHO being converted to —COOH. It is a good sequestering agent in alkaline media and is used in the dairy industry to remove "milk stone" and in the brewing industry to remove "beer stone," forming chelates with calcium, iron, copper and aluminium ions over a wide *p*H range.[6] In the milk, brewing and soft drinks industry bottles are washed with a hot solution of caustic soda, and in hard water areas deposits are left. Five parts of gluconate sequester one part calcium. Gluconic acid removes rust and is a corrosion inhibitor without attacking the metal. It does strip paint from metal parts but can be used effectively on aluminium, from which dairy equipment is frequently constructed.

Silicates

In detergent compositions inorganic builders provide subsidiary effects such as buffering or water softening. Some inorganic builders are detergents in their own right and among these are the polymers such as silicates and polyphosphates.

Silicates have good temperature stability, they are good buffering agents, are anticorrosive and are inexpensive. They have no chelating properties to sequester calcium or magnesium ions, causing instead precipitation, but they do sequester ferric ions. As sequestering agents for calcium and magnesium ions the polyphosphates complement the properties of silicates.[7] In colloidal silicates the SiO_2/Na_2O ratio is between 1·6 and 3·75 or SiO_2/K_2O between 2·1 and 2·5. Their solutions can be prepared in varying solids content with corresponding viscosities, but are opalescent. Hydrated powders have a SiO_2/Na_2O ratio of 2 to 3·2 and are easily soluble. Sodium metasilicate, Na_2SiO_3, occurs in the anhydrous form and as the pentahydrate and nonahydrate. Two crystalloid silicates are sodium sesquisilicate, $Na_3HSiO_4 \cdot 5H_2O$, and sodium orthosilicate, Na_4SiO_4, which may be crystallised from solution and are readily soluble in water.

Silicates are anticorrosive and are very effective in protecting aluminium. They have good suspending properties and lower the surface tension of water to a greater extent than equivalent solutions of other alkalis. The colloidal silicates exhibit greater surface activity than crystalloids. The soluble silicates lower the zeta potential of suspended siliceous particles and potassium silicate uses this property in connection with techniques of television screen formation. The suspending power of silicates in preventing redeposition of soils is due to the formation of a thin film on the fabric which can be easily rinsed off. The behaviour of silicates is synergistic with the other ingredients of a detergent mixture. They are utilised in ore flotation and deflocculation of clay. As buffers they maintain a high *p*H, but the preservative action of sodium silicate in preventing rancidity in soaps is not the result of buffering action. Of more interest to the textile industry, silicates preserve the tensile strength of fabrics. Their high alkalinity necessary for cotton bleaching is less damaging than other alkalis. The liquid colloidal silicates are used in the manufacture of the spray-dried detergents. They lower the viscosity of the slurry, impart strength to the spray-dried beads and stabilise the tripolyphosphates against conversion to orthophosphates. They are also inhibitors to caking tendencies. Typical household detergents contain 4 to 11% sodium silicate.

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ANTIBIOTICS

By I. L. S. Mitchell,* B.Sc., Ph.D.

Anti-fungal antibiotics ● New penicillin ● Production of 6-aminopenicillanic acid ● 6-Aminopenicillanic acid and related compounds Rheology of fermentation broths ● Viscosity of broths

Polyenic antibiotics

SINCE the isolation in 1951 of the antibiotic fungicidin (nystatin) by Hazen and Brown[1] and its characterisation as a conjugated polyene, many other polyene antibiotics have been studied in detail. The 40 or so named members of the group have been separated into tetraenes, pentaenes, hexaenes and heptaenes; in each group the members have three characteristic peaks of maximum absorption in the ultra-violet, within the range 290 mμ to 406 mμ. These polyenes contain carbon, hydrogen and oxygen, and sometimes also nitrogen, and are insoluble in non-polar solvents. All inhibit the growth of a variety of fungi, including yeasts, and none have any antibacterial activity.

Three reports[2,3,4] have indicated that streptomycetes producing polyene antibiotics are widespread, but how abundant they are is not known, nor despite this distribution, is much known of their biological significance. Reports[5, 6, 7] that polyene synthesis is stimulated by the supplementation of growth media with nutrient oils or with oleic, palmitic or mevalonic acid suggest that biosynthesis is effected through some modification of fatty acid metabolism.

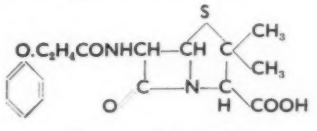
The polyenes are generally too toxic for therapeutic use, but the tetraene fungicidin and the heptaenes candicidin, trichomycin and amphotericin B have found clinical

* Glaxo Laboratories Ltd.

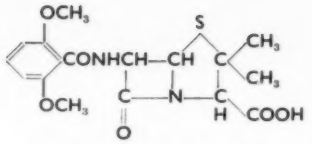
applications in the treatment of yeast infections. Even these produce severe side-effects when administered intramuscularly and are normally used orally or topically—a procedure that limits their effectiveness. Amphotericin B has emerged during the past few years as the most promising drug available for the treatment of the deep fungal diseases—blastomycosis, histoplasmosis and cryptococcosis—and is usually given by intravenous infusion, mixed with glucose solution, over a period of several hours in order to minimise side-effects. These can be severe and include fevers, nausea, vomiting and headaches[8,9] in patients treated successfully for American leishmaniasis or other mycotic infections. It is of interest, therefore, that a recent report[10] describes successful oral treatment of experimental mycotic infections in mice with a solubilised amphotericin B. This is a preparation of the antibiotic and sodium disoxycholeate, normally used for infusion into human subjects; when added to water, it produces a colloidal suspension of fine, evenly dispersed particles. It is believed that the high amphotericin B blood levels produced in mice with this preparation can also be produced in man; if this proves practicable, the treatment of deep fungal infections in man will have taken a step forward.

Penicillinase-resistant penicillin

During the past twelve months considerable progress has been made in the study of penicillins. The preparation and isolation of 6-aminopenicillanic acid—the penicillin nucleus—was reported during the autumn of 1959[11] and a brief account of the work was given in these Progress Reports for February 1960. Soon after, preparation of a new penicillin (α-phenoxyethylpenicillin) by chemical synthesis from 6-aminopenicillanic acid was announced.[12] Knudsen and Rolinson[16] have now described the synthesis from 6-aminopenicillanic acid of 2 : 6 - dimethyoxyphenylpenicillin (BRL.1241), and results of both laboratory tests and clinical trials have been published.[17,18,20,21]



α-Phenoxyethylpenicillin



2 : 6-Dimethoxyphenylpenicillin

The significant feature of BRL. 1241 is its ability to resist hydrolysis due to the enzyme " penicillinase ".[14] Particular strains of staphylococci are able to produce penicillinase and are therefore resistant to therapy with penicillins. As a result of the use of the penicillins over a long period of time, there has been a gradual selection of these penicillin-resistant staphylococci, with the result that cross-infection due to the high incidence of these organisms has become a serious problem, particularly in hospitals. R. E. M. Thompson, J. W. Harding and R. D. Simon[19] state that of 1,118 strains of staphylococci isolated at the Middlesex General Hospital no less than 82% were insensitive to penicillin G, but all were sensitive to BRL.1241.

BRL.1241 used normally in the form of the sodium salt is a white powder, very soluble in water and, like penicillin G, unstable in acid solution.[16] Necessarily administered by injection, its pattern of adsorption and excretion is similar to that of penicillin G. The antibacterial spectrum also is similar to that of penicillin G, though not as extensive.[14] For example, *Salmonella paratyphi C* was inhibited by a concentration of 0·2 μgm. ml. of penicillin G but was unaffected by BRL. 1241.

Against penicillin-sensitive organisms BRL.1241 has only about one-hundredth the activity of penicillin G,[15] so that higher doses are required for maintenance of a suitable blood level.

Tests *in vitro* have shown BRL. 1241 to be unaffected by penicillinase,[14] and clinical trials on human subjects infected with penicillin-resistant staphylococci have demonstrated the superiority of BRL.1241 over the other known penicillins in infections of this type, some dramatic clinical improvements having been recorded. Elek and Fleming[22] have described how infection due to penicillin-resistant staphylococci was cleared completely by spraying BRL.1241 solution at regular intervals in a maternity ward.

Surprising results were obtained by Knox,[14] who found that penicillin-resistant staphylococci, after being sub-cultured several times in the presence of BRL.1241, had become sensitive to penicillin G, despite the fact that, though resistant to the action of penicillinase, BRL.1241 will stimulate the production of this enzyme by organisms known to be capable of producing it.

G. T. Stewart and P. M. Harrison[15] have not been able to detect any acquired resistance by organisms to BRL.1241 *in vitro* over a short period of time.

BRL.1241 having so far proved to be as lacking in toxic side-effects as penicillin G,[13] it will probably establish for itself a defined place in therapy.

Production of 6-aminopenicillanic acid

The hitherto recognised method of producing 6-aminopenicillanic acid has been by the normal type of penicillin G fermentation, but in the absence of the phenylacetic acid precursor. Separation of the product from fermentation media is difficult, because its amphoteric nature renders it unsuitable for the simple and rapid method of solvent extraction used for the extraction of penicillin G.

Three recent publications describe alternative methods of preparation in which penicillin G is hydrolysed in the presence of an enzyme. The method illustrates how micro-organisms can bring about a chemical change not to be achieved by purely chemical methods.

G. N. Rolinson *et al.*[23] have shown that some organisms, mainly of the genera *Escherichia* and *Alkaligines*, are capable of producing enzymes in the presence of which penicillin G and some of the other penicillins are converted to 6-amino-penicillanic acid; under modified conditions they will also catalyse the reverse reaction. Similar work has been reported by Claridge *et al.*[24] and Huang *et al.*[25] The enzyme is produced together with cellular material by growing the organisms in a nutrient medium. The cells are removed by centrifugation, and put into a buffered aqueous solution of sodium penicillin; the mixture is then incubated for several hours at 37°C. Isolation of the 6-aminopenicillanic acid is more easily carried out from the relatively pure solution in which it is prepared than from fermentation broth. This route for the preparation of 6-aminopenicillanic acid seems attractive, since many years' experience in the pro-

duction and extraction of penicillin G should make it more economic than the method of direct fermentation.

6-Aminopenicillanic acid and related compounds

The presence of 6-aminopenicillanic acid in fermentation broths can be shown by a chromatographic technique in which a paper chromatogram is sprayed with phenylacetyl chloride to convert the 6-aminopenicillanic acid to penicillin G. The penicillin G zone is then detected by placing the chromatogram in contact with a surface of agar seeded with *Bacillus subtilus*. After incubation, the agar is examined for a zone of inhibition of growth.

Using such chromatographic methods Wolff and Arnstein[26] have detected the presence of three "phenylacetyl chloride reacting" substances, other than 6-aminopenicillanic acid, in 6-aminopenicillanic acid fermentations. The presence of such compounds and the possibility of attaching different side-chains by chemical reaction may result in some further striking achievements in this field of research; indeed, the isolation of other groups of penicillins differing from the known family (based on 6-aminopenicillanic acid) in the structure of the nucleus seems to be a possibility.

Rheological properties of fermentation broths

More attention has been given in the recent literature to the rheological properties of fermentation broths.[27,32] They are of importance because of their effect on the distribution of the power from the impeller in a fermenter. This naturally affects the flow patterns in the tank, which in turn affect the distribution of air sparged into the fermenter. The distribution of shear within a fermenter also has a bearing on the heat and mass transfer within the broth itself and also on the heat transfer between the broth and any cooling surfaces or the walls of the fermenter. For these reasons a knowledge of the rheological properties of any fermentation broth being handled is important.

In general, most bacterial broths behave as Newtonian liquids, or approximate to this condition, whereas many mycelial broths are non-Newtonian, of the pseudoplastic type. Deindoerfer and West[27] have examined four industrially important broths and found that penicillin and steroid hydroxylation broths were markedly pseudoplastic. The two broths of streptomyces strains were Newtonian, although streptomycin broth became pseudoplastic at some stages. However, appreciable changes in rheological properties were noticed during the course of all the fermentations.

A characteristic of a pseudoplastic liquid is that its apparent viscosity decreases with increasing shear rate.[28] This has an important bearing on the flow patterns obtained in a fermenter and consequently on the heat and mass transfer. Metzner and Taylor[29] have studied the flow patterns obtained with a pseudoplastic liquid in a cylindrical baffled tank by following the movement of small highly illuminated particles. They conclude that under conditions of good mixing essentially all the highly turbulent mixing takes place near the impeller, the motion in the rest of the tank merely serving to bring fresh liquid to this region.

When air is sparged into the broth there is a tendency for it to remain in the highly turbulent region round the shaft, probably owing to the lower apparent viscosity and a centrifugal effect.

Finn[30] used a different method of measuring the flow patterns, a strain gauge being inserted into the tank at different positions; however, difficulty was experienced in obtaining a suitable gauge.

A further use for rheological data is suggested by Deindoerfer and West:[27] they consider viscosity to be a better indication of the growth of the organism than the dry weight of the cells, since this is affected by the amount of the non-cellular solids suspended in the broth.

Measurement of viscosity

With a non-Newtonian liquid, whose apparent viscosity depends on the shear rate, capillary viscometers cannot be used, because the shear-rate varies throughout the measurement; there is also the risk that the capillary will become blocked or constricted by the mycelium. Consequently for non-Newtonian broths some form of rotating spindle viscometer is necessary, such as those of Brookfield or Ferranti. Fitch[31] describes the procedure for interpreting the figures given for plastic substances by a Brookfield viscometer into yield stress and plastic viscosity.

Some thick broths exhibit thixotropy, that is, their apparent viscosity falls with continued stirring at a constant shear rate.[28] Although thixotropy probably has little or no effect on the flow patterns in a fermenter because of the general turbulence, it can cause great difficulty in measuring the viscosities of mycelial broths. All rotating spindle viscometers depend on the fact that they operate in the streamline or viscous region of flow, so that the power is proportional to the viscosity for a given spindle and speed. In this condition thixotropy is most apparent, since the shear stress falls away with increased stirring time, so that the shear stress for the unstirred broth can only be found by extrapolating back to zero time. Fitch suggests one method of overcoming the effects of thixotropy with a plain rotating cylinder by stirring at a higher speed than is required for the measurements; when a steady reading is obtained, the speed is reduced to the desired value and the reading immediately noted. The speed is then increased before being altered again to the next speed for measurement.

Another solution is to use a "T"-shaped spindle that is simultaneously lowered into the sample as it rotates, so that the arms of the "T" are always moving into unstirred liquid. This is the method used by Brookfield. In my experience difficulties have occurred when this system is used on a mycelial broth. Pieces of mycelium tend to become caught on the cross arms of the "T" and so cause a sudden rise in reading. Eventually the pieces fall off; the result is a widely fluctuating reading of the shear stress.

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(*Continued on page* 540)

NEWS AND VIEWS OF THE U.S. PHARMACEUTICAL INDUSTRY

by Rolf Silken

Too much government interference ★ Danger sign—slow down of research ★ The veterinary industry sector hard hit by new FDC regulations ★ The U.S. New Drug Application regulations important to firms abroad ★ Problems worrying the industry.

Because of its size and power the American pharmaceutical industry has significance far beyond the territory of the United States. Its prospects and problems are of particular interest just now because of the growing influence of Federal and State laws. Here is the first of a series of interpretative reports on the industry written by an experienced pharmaceutical correspondent in America.

MANUFACTURERS of pharmaceutical preparations outside the U.S. seemingly do not know how much luckier they are than their American counterparts whose every step will soon be guided by so many government regulations and limitations that they interfere with the industry's production and sales effort. No longer is the U.S.A. the country of completely free enterprise and of unlimited possibilities. Federal and State governments now influence to a large extent the future of pharmaceutical enterprises through often too elastic laws, often too indefinite regulations, and often too strict interpretations concerned not only with quality control, but also with research programmes, production procedures, and sales promotion.

I am afraid that too many politicians and Government lawyers—who apparently are now dominating the F.D.A. (Food and Drug Administration), F.T.C. (Federal Trade Commission), and U.S.D.A. (U.S. Department of Agriculture, particularly its Insecticide Division)—in their power hunger do not see the inevitable danger to which they expose a great industry: the danger of slowing down its scientific progress because all business enterprises must now face enormously increased expenses needed for compiling satisfactorily large numbers of case reports to show that a drug is not only non carcinogenic and safe, but also effective; and they must declare on the labels and in the labelling, in Caution and Warning statements, all the side-effects and the limitations of their products.

Research curtailed

The situation is so difficult that many manufacturers, even large ones, particularly those of veterinary products, are now limiting their research programmes since they cannot afford to take on the additional risks and expenses inherent in research work. This is particularly true of the veterinary sector of the pharmaceutical industry which is expected to supply tissue residue and other safety and efficiency data for each of the species to which a product is intended to be administered. While manufacturers of human medicines get by with laboratory animals—as yet!—veterinary houses are expected to sacrifice a large number of cattle, equines, sheep, goats, swine, dogs, and cats—*i.e.*, whatever species the new drug is to be used for, or for whatever new claim is to be made for an old-established drug. I know of drugs which may never become available for meat-producing animals, even though they may have great therapeutic value and would offer good sales volumes: yet the financial risks are so great and the time required for F.D.A. clearance is so prolonged, that these pharmaceutical products may, at best, become available for pet animals only.

It often takes much longer than a year to obtain a final New Drug Application, from the F.D.A., which means that from starting the research work until marketing the product two or three years may go by, if not more. Consequently by the time clearance is obtained it is often not worth marketing the drug, owing to the changed market conditions.

This situation concerns not only the American drug manufacturer—it is of importance also to our colleagues in Great Britain, Europe, and the rest of the world for a number of reasons: First, because many of them export raw materials, some also half-finished and packaged drugs, to the U.S.A. so that they, too, have to comply with all Federal laws and regulations and the difficulties outlined here apply to them as well. Secondly, (and as I see it, maybe even more important), it appears that the possibilities are now great for the alert European, Russian-Satellite, and Japanese pharmaceutical industries to successfully compete with us for leadership in the development of new drugs and bring them on the world market long before they can be offered in the U.S. Thirdly, I foresee closer American-European collaboration in research and production, maybe also an increase in the American trend to establish subsidiaries abroad. It looks to me that such steps will have to be taken to make it possible to obtain early returns for American research efforts and expenses. Thus, Europe and other parts of the world will reap the benefits of new, effective drugs long before they can be offered to the American public.

Outstanding problems

Among the many problems now concerning the American drug industry (which will be dealt with here more fully in the future) are the following: The shifting of drug sales from drug stores to food stores; the changes in the distribution policy of the drug industry by squeezing out the wholesalers; journal advertising and package-brochure regulations (both emphasising adequate warnings); certification of colour for foods, drugs and cosmetics; warning statements on labels of household chemicals; permissible food additives; the exaggerated cancer scare; N.D.A. requirements; milk residue policy; new antibiotic regulations, etc.

By discussing these problems in these pages, I hope to be of help to my colleagues in Great Britain and

other countries, awakening them to the dangers they, too, will be in if and when similar legislations should be introduced by their governments. Such tendencies already exist abroad —in Canada, Great Britain, Germany, France, etc. Rather than have dozens of laws, from very simple and practically ineffective ones to the too strict ones now proposed in the U.S.A., I would like to suggest that the authorities of all countries interested in the current status and the future development of the drug industry join forces to establish uniform regulations applicable to all countries belonging to the World Health Organisation.

Maybe the W.H.O., which has been so successful with its International Pharmacopœia, could also become the initiator of an International Food, Drug and Cosmetic Law.

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Soviet Journey

High Prices, Hard Work and Some Private Enterprise

By Edward Gurr,* F.R.I.C., F.L.S., F.R.M.S., M.I.Biol.

RUSSIA proper is a European country. Besides Russia, the Soviet Union is composed of a number of autonomous states, each with its own language, its own national dress and its own way of life. Our itinerary took us only as far to the east and south-east as the regions bordering on China, India, Afghanistan, Persia and Eastern Turkey. All the autonomous states of the Soviet Union are in Asia except Georgia, which is neither in Asia nor in Europe. Among the cities visited were Bokhara, Samarkand, Tashkent, Tiflis (capital of Georgia), and Erevan (capital of Armenia). These ancient cities are rapidly losing their old character and are becoming modernised, with many new buildings. There are many schools, universities, polytechnics, medical colleges; medical, biological and agricultural research establishments, equipped with modern instruments and apparatus, mainly of Soviet manufacture.

There are no longer any camels to be seen along the golden, dusty, pot-holed road to Samarkand but there are many lorries. Small-scale private enterprise flourishes in the autonomous states, and goods are cheaper than in Russia itself, the shops less crowded because there are relatively more of them, and traders are more anxious to please, perhaps because the profits go directly to them instead of to the State.

Cost of living

In Russia proper, life is more rigorous; the Government owns everything, and everybody is a civil servant; shops are few and queues are long; consumer goods are scarce and fabulously expensive, and apparently you can take it or leave it. I saw braces marked at the equivalent of 45s. a pair, trousers at £10, a raincoat at about £135, a nail brush (worth 6d.) at 10s., and imported British handcream (costs about 1s. in Britain) 13s. Beer cost 5s. 6d. to 12s. 6d. for a bottle of about ½ pint, while Soviet table wines (as exported to and sold in Britain) are priced at the equivalent of 20s. to 68s. per ½ litre bottle. Bread cost about 1s. 5d. per lb., fish averages about 4s. lb., tobacco (Soviet) about 3s. to 9s. 9d. per ounce, cigarettes (Soviet) about 3s. to 7s. for 20. Newspaper-tobacconist kiosks carry large announcements: "Cigarettes are poison" on one side, and on the other "All cigarette prices reduced by 5%." The above quoted prices are those paid by the Soviet people. Foreigners get a very favourable rate of exchange so that they buy goods at two-fifths of these prices.

The capital

Moscow is a spacious city with many skyscraper blocks of flats, government offices and hotels. One of the hotels we stayed in had 30 storeys and no staircase. We were assured that it was most unlikely that there would be a power failure on the lifts coinciding with a fire, which was a comforting thought. Moscow thoroughfares are tree lined, with plenty of holes in the pavements where you could easily turn your ankle. There is a great deal of traffic, all in a great hurry. The main thoroughfares are frightening in their great width and there are no refuge islands in the middle for pedestrians. The police are very helpful; one of them left his post where he was engaged in controlling traffic, went several hundred yards down the road to call a taxi for us.

Work, education and holidays

Manual workers put in 42 hours a week (6 × 7-hour days), while

* Mr. Gurr and his wife, F. P. Gurr, B.SC., who accompanied him on the journey, are directors of Edward Gurr Ltd., manufacturers of *Michrome* stains and reagents for microscopy and biology. He is the author of "A Practical Manual of Medical and Biological Staining Techniques," "Methods of Analytical Histology and Histochemistry," "Encyclopædia of Microscopic Stains," "Microscopical Staining Techniques," etc., published by Leonard Hill Ltd.

Mr. Gurr and his wife are experienced travellers in Eastern Europe and we have previously published his impressions of Hungary (just before the 1956 rising) and of Turkey. Last September they penetrated the heartland of communism and here are some characteristic impressions of Mr. Krushchev's Russia.

Edward Gurr

office workers put in 48 hours (6 × 8-hour days). Trade unions appear to function solely as sick clubs. Only 3% of the population belong to the Communist party. Membership is a great honour and is only accorded to those who have " done a lot of work for nothing . . . Social work or other work for the betterment of the Soviet people."

School begins at the age of seven years; bright children may go to university when they reach the entrance age (16). There are also " sandwich courses." All education is free and the government have the right to send graduates to work in any part of the Soviet Union where they are most needed.

Medical attention and hospital service is free, but prescriptions have to be paid for.

Anybody who can afford it may take a holiday in any of the neighbouring countries, but nobody is allowed to visit a non-communist country except on official business or with special permission from the government. There is so much to see within the Soviet Union and internal air fares are so cheap that they have no interest in going outside.

Religion is not banned, but it is not encouraged and churches pay rent to the government. There are churches of all denominations, all built before the Revolution, but I did not see any new ones. They are always full; the congregations are mostly old and middle-aged, but some young people also attend the services. It was noticeable that soldiers and sailors removed their caps on entering churches. A religious revival within the next few years would not surprise me.

Listening to British and American broadcasts is not forbidden, but " nobody is interested and nobody wants to listen to capitalistic propaganda." . . . " Well, how many British people listen to Soviet broadcasts?" Tips are politely but firmly refused. The Soviet people, especially the Russians, appeared to be very friendly, kindly and courteous people, quiet, unsophisticated and unassuming; usually unsmiling, but with a sense of humour not unlike our own.

Inferiority complex

They do not like being laughed at and their achievements belittled by Western newspapers, and frequently complain of this. The Russian people suffer from an inferiority complex. " We know our standard of living is not as high as British and American, but we started with nothing after the revolution. We had to start all over again after the last war. We *must* have a communist government ! We cannot have opposition. It would cause delay. We have to work hard together. Later, when we have done all these things, we shall have time to improve our standard of living." My impression was that before very long private enterprise will be extended, on a limited scale, to the whole of the Soviet Union, as a means of producing reasonably priced consumer goods of good quality.

The Georgians

The Georgians are a noisy, happy-go-lucky people. They are probably the wealthiest of all the Soviet states. Many of them are fruit farmers, or they raise sheep, goats and cattle. These people thrive on private enterprise and sell their produce to the Russian market at very handsome prices. They are black-haired, hairy people. Most of the men are unshaven and many of the women have moustaches, some of which are carefully waxed; there might be an opportunity here for British cosmetic manufacturers interested in export.

Life is much harder in Moscow and other European cities, where all the people are equal. However, even in Russia proper it is possible to have a motor-car and a house in the country, provided the combined income of your wife and yourself can run to it, or if you have rendered special services for the betterment of the Soviet people. All wives in Russia work. " It is necessary." One can quite believe this after looking at the prices of goods, even though rents are cheap.

Families in Russia are small; usually two children, rarely more than four; but families are larger (10 or 12 children) where the climate is warmer (in the autonomous states) and life is easier and diet more varied and cheaper.

Pharmaceuticals and toilet goods

Pharmaceutical products are presented in unattractive packs usually of the type current in the time of Charles Dickens. Cosmetics are attractively packed, but somewhat out of date, the pack looking similar to those used by our manufacturers about 20 years ago. There might be splendid opportunities here for British pharmaceutical and cosmetic manufacturers with tenacity and who do not easily take " Neit " for an answer.

I was told that pharmacists are " very poorly paid." *Note:* A pharmacist's salary for a month would be insufficient to buy a raincoat! (1,345 roubles).

My impression is that it is the Russian people who make sacrifices not only for the Soviet people of the autonomous states but also for the other communist countries of Europe.

A FEW STATISTICS

	Average rates of pay Roubles per month
Ordinary workman or workwoman	800
Pharmacist	1200
Doctor (G.P.)	2000
Chemist	3000
University professor	3000
Physicist	3000
Collective farmer (self-employed)	3000

Official rate: 11 roubles = £1
Tourists' rate: 28 roubles = £1

Love's Labours Resumed

By John Brooks

FROM OUR SPECIAL CORRESPONDENT

Budleigh Salterton (*Mother's Day*). The inaugural meeting of the British Gerontotherapeutical Society was exceedingly well attended, delegates coming from as far afield as Cheltenham, Bournemouth and Tunbridge Wells. After routine business, including the installation of a president and the reading of a statement *in absentia* by the treasurer, who was on a visit to South America, the chairman welcomed the distinguished centenarian, Sir Aneurine Silenus, and asked him to deliver his paper "Hormones and the Housewife." Your correspondent is indebted to the Society for permission to quote and summarize (verb. report *J. Proc. B. Ger. S.*, Vol. I, No. 1).

After introducing his subject, which the speaker had heard described as fulfilling a long-felt want, he said that he was particularly glad to see so many young people present. It was during the formative years that habits were moulded which would affect a whole lifetime. Representatives of the expanding pharmaceutical industry were also welcome and able to see for themselves the long-term results of rejuvenation research and patient salesmanship.

He then referred to the case of a Mrs. Crucible, the medical history of whose youth had been anything but happy. Rickets complicated by intractable night-blindness and a humiliating slowness in coming to puberty had turned her into a solitary child, morbidly introspective, a prey to imaginary symptoms of scurvy, beri-beri, and a future darkened by sprue.

At the time the patient was referred to me (Sir Aneurine went on) she was in her late thirties. I saw at once that her colour was good, that her mien was composed, I might almost say resigned, and that a good two inches of slip was visible over her lisle stockings. She volunteered the information (I take it from my notes) that she was " a tennis club reject." During the necessarily protracted examination which I made of her patellar reflexes, she read the weekly gardening notes with evident enjoyment. I unhesitatingly diagnosed a deep-seated disorientation associated with systemic deficiencies too numerous to mention here.

She was put on to a daily regimen which included three tablets of bone meal, four of wheat germ, six of vitamin E, three of vitamin A, seven of brewer's yeast, six methionine, and two each of œstradiol and methyltestosterone. These were to be regarded as in lieu of normal food, and were to be assisted by a reduction in the hours of sleep and a course of foreign reading. She remained in my care until her marriage (by an odd chance, to my assistant) some three weeks later.

During the ensuing 20 years I was unable to follow her case closely, as her subsequent marriages took her to many parts of the world. We can only recall that she buried an Argentinian in her middle fifties, and later was to rise on her own merits to be the head of the household establishment of a well-known, but now unhappily demised, eastern ruler. Indeed, I did not examine her again until her appearance a few years ago at the West London magistrates court, when I saw her at the request of the Probation Officer. I found her to be a healthy, well-set-up woman, rising eighty, and exceedingly attentive to her appearance except for a vestigial ladder which I detected at the proximal end of her left nylon in the median line. Her colour was better than ever. I found trans-methylation active with little hysteresis and a lack of muscular dystrophy which had surprised the police. I prescribed ginseng before retiring and 5 mg. progesterone, and gave her the name of a leading counsel.

In conclusion, Sir Aneurine was happy to say that the patient had since established a happy liaison with a Swiss, and at the time of speaking was a skiing instructress at Zermatt. There was a lesson, he said, for all of them in that case history which, if perhaps supranormal today and requiring (he smiled) specialist treatment, would in the enlightened years to come be a commonplace, and he was sure that the great strides being made in endocrinology would make gerontologists synonymous with pædiatricians (loud laughter, much of it from the back of the hall). He spoke with evident emotion and an upraised hand when he defied hypervitaminosis, and the fate presaged in Ecclesiastes XXII, when no more should " the almond tree flourish, the grasshopper be a burden " (prolonged applause) " and the sound of the grinding be low " (standing ovation).

Upon this note of optimism, willing helpers having moved among the crowd dispensing heart stimulants, the meeting broke up *sine mora* and *sine die*.

Homeric laughter, the crash of glass and the cries of the vanquished fractionated above the ancient township as your correspondent swallowed his daily dose and caught the 6.30 for Waterloo.

FACTORIES ACT (*Continued from page* 527)

Heavy weights

Section 20. Lifting excessive weights. Protection given to young persons is extended to adults. The law says, " A person shall not be employed to lift, carry or move any load so heavy as to be likely to cause injury to him."

Miscellaneous

Section 21. Special regulations for safety and health. The Minister's existing powers are extended so that he can now prohibit or control dangerous materials, etc., before they are used in a factory.

Section 22. Prohibition of importation and sale of prohibited materials and articles made therewith. Such import may be prohibited if the material or article is made with substances or processes prohibited by Factory Regulations.

Section 23. Exemption from provisions regulating hours of employment. The Minister may, on application being made to him, relax some of the restrictions on the hours of work of women and young persons aged 16 or over, in the interests of efficiency.

The remainder of the Act and the attached Schedules deal with various administrative and other matters, which space does not allow to be summarised here. Under section 26, for example, the Minister is given a *duty* to promote health safety and welfare in factories, and under section 29 maximum fines for breaches of the Acts and Regulations are increased.

Promotion Costs and Drug Prices

By Our Westminster Correspondent

DRUG manufacturers included in their manufacturing expenses such promotion costs as continental holidays offered as prizes to pharmacists, said Mr. Kenneth Robinson (Labour, St. Pancras, N.), enquiring in the Commons last month to what extent the Minister of Health took such expenses into account in approving the costs of new drugs prescribed within the National Health Service.

Mr. Enoch Powell replied that he was aware of one recent instance of this, but he was told that the firm concerned did not intend to use this type of sales promotion in future. He added: "The costs of new drugs prescribed within the N.H.S. are not subject to my approval."

Mr. Robinson asked if the Minister would not agree that this type of advertising, which was indulged in by Aspro-Nicholas in trying to introduce a new antibiotic, could only reflect adversely on the pharmaceutical industry as a whole. "Will you do all in your power, by persuasion, to see it does not happen again?" he said.

Mr. Powell: "Yes, sir."

Drugs for private patients

On a rough estimate, the extra annual cost of providing drugs and dressings on National Health Service terms for residents in Britain not now registered with a N.H.S. doctor might be between £2 million and £3 million, Mr. Powell informed Sir Malcolm Stoddart-Scott (Conservative, Ripon).

Foot-and-mouth vaccine?

The serious and widespread outbreaks of foot-and-mouth disease received considerable attention in Parliament last month.

One Conservative M.P., Mr. Mark Woodnutt (Isle of Wight), wanted to know if the new Minister of Agriculture, Mr. Christopher Soames, had considered information sent to his predecessor in April, 1959, about a method of providing immunity from the disease. The Member urged Mr. Soames to consider instructing his department to investigate and test the product employed in this method with a view to its possible use in the United Kingdom.

The Minister replied that foot-and-mouth disease was not endemic to this country and the Government's policy was to use all practicable safeguards against its introduction and to slaughter animals infected or in contact with the disease. "It does not permit vaccination or other prophylactic measures, so I would see no advantage in investigation of this product," he added.

Research

Forty scientists and 158 supporting staff are engaged in research work at the Foot-and-Mouth Disease Research Institute at Pirbright, Surrey, it was stated. Cost of the work in the current financial year will be about £300,000.

Polio vaccine

At September 30 last, 13,333,000 people in England and Wales had been vaccinated against poliomyelitis, the Health Minister reported.

He said that 76% of those under 18 and 52% of older persons up to 28 had had at least two doses of vaccine by that date. The figures did not include any of the 687,000 people in the special priority groups, not classified by age, who had received two doses.

In Scotland over 1,600,000 people had received vaccination against polio by September 30. The figure included 82% of children born since 1943 and 42% of those born between 1933 and 1942—*i.e.* the adolescents and young adults.

The Government, it was said, were continuing to publicise the facilities available for vaccination and the need for persons not yet vaccinated to come forward. Family doctors were playing an active part in the campaign.

Borax duty

The President of the Board of Trade, Mr. Reginald Maudling, was questioned about an application which had been made for the removal of import duty on refined borax.

He said the decision was that anhydrous borax should be exempt from duty and an Order giving effect to this had been laid.

Thirteen applications for abolition or reduction of import duty which were before the Board of Trade last month included: Ammonium sulphate, methanol, aluminium lithium hydride and calcium hydrogen orthophosphate.

They had been announced at various times in the *Board of Trade Journal* to give interested parties an opportunity to express their views, Mr. Maudling explained.

Starch dumping

Asked what was the position with regard to an application for an anti-dumping duty on starches imported here from West Germany, the President said the German manufacturers had agreed to raise their prices to eliminate the dumping. The Board of Trade was, therefore, taking no further action about the application.

Variable teaspoons

A medicinal tail-piece was provided by Mr. Norman Dodds (Labour, Erith and Crayford). He drew attention to "the dangers which arise from the wide disparity in the size of teaspoons which are used for taking medicines, especially by children."

COINING CHEMICAL WORDS

A paper read recently before the chemical marketing and economics division of the American Chemical Society gives details of methods and pitfalls to be avoided when coining names for chemical and allied products.

A copy of this paper, "Coining Chemical Words," can be obtained by sending a stamped addressed envelope to The Cheminform Institute, 10 Columbus Circle, New York 19, U.S.A.

▶TABLETING AND DOUBLE COATING MACHINE

With the Manesty *Bi-Cota* machine two separate coatings can be applied to the core. This takes place immediately after pressing, thereby reducing the risk of core contamination. Also since handling of the core is eliminated, due to the automatic transfer mechanism, it can be made relatively soft, thus assisting the binding of the coating and also giving more effective control over disintegration. The machine can produce drycoated tablets with two coatings, drycoated tablets with one coat, three layer tablets, two layer tablets and normal uncoated tablets.

These machines have Meehanite turrets fitted with Holfos bronze wheel rings driven by hardened and ground steel worms, the drive incorporating a clutch; this type of gearing is suited to high-speed operation. All parts of the transfer units in contact with the material are of stainless steel. A core sampling device to allow checking of core and core plus first coat, for weight and density, without stopping the machine, and a core detector for rejecting faulty tablets, are all fitted on the standard machine. The machine is adequately guarded and a transparent powder level indicator is fitted in each hopper.

The controls are grouped on one panel. Adjustments are provided for the depth of fill and pressure on each turret as well as for thickness of coating above and below the tablet core. Output is infinitely variable and adjustments can be made while running the machine.

▶FLASH DRYING SYSTEMS

Raymond flash drying systems, introduced to this country by International Combustion Products Ltd., are used to remove definite amounts of moisture from damp, granular or fibrous material. The material is circulated in a hot, turbulent gas stream, causing the rapid transfer of heat and evaporation of moisture. When simultaneous drying and grinding is required, a disintegrator or pulveriser is included in the system. The finished product is separated, cooled and conveyed in a dust free plant operating under suction, and its dryness and particle size may be accurately controlled.

An indicating temperature controller introduced by Honeywell Controls Ltd. designed for heating and cooling operations, serving the double purpose of indicating and controlling temperatures in ovens, plating baths, dryers and similar installations. A selection of ranges is available from −50°F. to +1,200°F. Centigrade scales are supplied if required.

Flash drying systems are designed to dry under three distinct conditions: drying without disintegration, drying with disintegration, and drying and pulverising.

Hot gas is supplied either by direct firing, indirect heating or the use of waste gas, and International Combustion furnaces operating on gas, oil or coal and heat exchangers are provided to meet these conditions. Several wet feeder arrangements are available, allowing the rate of feed to be changed as required. The mixer is used to condition the incoming wet feed by blending it with previously dried material. A product is thus obtained which can be easily picked up by the hot gas stream. A cage or impact mill is incorporated in the system when simultaneous drying and grinding is required. Wet material is fed into the hot gas stream and the mixture then enters the mill axially. The product leaves the mill almost completely dried, but mixed with the gas. After passing through the uptake pipe, this mixture enters the cyclone collector, where separation occurs, and the moisture-laden gas is discharged to atmosphere through the vent fan. A bag filter, cyclone, or wet scrubber are sometimes included in the system after the exhaust fan. The dry divider proportions the finished product when dry return is needed for conditioning the incoming wet feed. This proportioning device may be either manually or automatically controlled.

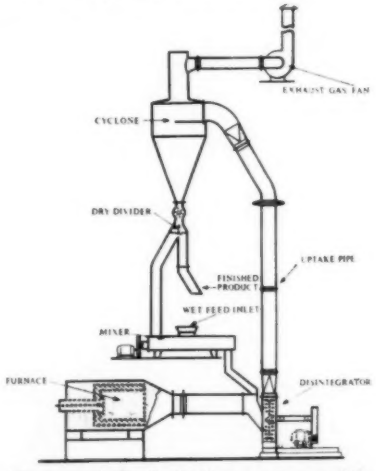
▶PORTABLE ACID PUMP

The *Chemix* portable pump unit is used to transfer corrosive fluids. It has a maximum capacity of 600 gal./hr. and a maximum lift of 15 ft. and when the head is reduced a capacity of over 600 gal. can be obtained. The immersion depth is 2 ft. and the gland unit is fitted with a special double seal. This seal and the motor shaft coupling are housed just below the motor and are easily visible and accessible through the perspex guard. All parts in contact with the corrosive material are constructed in PVC including the outlet hose.

The specially designed motor unit is a $\frac{1}{7}$ h.p. totally-enclosed series wound universal type suitable for operation on 230 V or 110 V single phase at 3,000 r.p.m.

Incorporated into the handle is a special contact switch making control easy.

The pump, manufactured by F. and R. M. Harris (Birmingham) Ltd., can also be supplied with a 3 ft. suction and it can be manufactured in FMB quality stainless steel.



Raymond flash drying system with disintegration showing direct oil firing, cage mill, mixer and dry divider.

A fume scrubbing tower fabricated by Tough Plastics Ltd. has recently been delivered to Electrochemische Werke in Munich. The specification was particularly rigorous, calling for high corrosion resistance at higher than normal temperatures coupled with strength and lightness.

▶MOBILE CRANE

Chamberlain Plant Ltd., have introduced a new *Staffa* mobile crane which will be manufactured at their works at Enfield. This crane will ultimately replace the original and popular Staffa Three and Staffa Four cranes.

The new crane with its hydraulic luffing gear is not only able to luff under load, but is now fitted with a double acting ram to speed up this operation.

While similar in appearance to its predecessors, the new crane is more robust, with increased visibility from the driving position provided by the new open type A-frame. To ensure operation under the most arduous conditions, a heavy duty hoist box has been incorporated together with a new heavy duty differential and a cast steel axle casing. Smooth working results from the provision of hydraulic brakes as standard equipment.

With standard jib the maximum capacity is 4 tons at 3 ft. clear outreach, and 1¼ tons at 10 ft. clear outreach. All loads can be lifted free on wheels and capacities are based upon the safe working load, being a minimum of 66% of the tipping load.

The power unit is a Ford Dexta three-cylinder water-cooled diesel engine developing 27 b.p.h. at 1,500 r.p.m. There is a 9 gal. fuel tank and consumption is about 2 gal. for an average eight hour working day.

The crane has been designed so that all parts are readily accessible, and although this means that the body of the machine is slightly wider than that of previous models, the manœuvrability has not been affected. The overall height of 10 ft. 3 in. permits operation within most industrial buildings, and the degree of manœuvrability is such that the crane will travel down a 6 ft. 6 in. gangway, or will perform a right-angle turn from a 13 ft. gangway.

A simple extension fitment permits the standard jib to be converted to a long jib to provide greater lifting heights and outreach, whilst the swan neck extension is also available for operation where bulky loads require to be handled.

The crane is supplied complete with a cab and all ancillary equipment.

▶VIBRATING MILLS

Ball milling is a process used frequently and when operated correctly has the advantage of producing a fine and uniform product. Ball mills, however, absorb high power, but the latest Sturtevant vibratory ball mill is claimed to achieve fine grinding with considerably reduced power.

The vibratory ball mill consists, essentially, of a container filled with grinding media (usually balls), the material to be ground being distributed in the interstices between the media. The container is excited in the vertical plane into vibrations of high frequency and large amplitude, and grinding is effected by the impacts between the balls induced by the motion of the container.

The advantage of this mill over the conventional ball or tube mill is the avoidance of the limitation imposed on the rate of grinding in the tube mill by the so-called " critical speed," the speed at which the charge adheres to the mill shell. In general, rotating mills operate at speeds of rotation less than 80% of the critical speed, and this imposes an upper limit on the rate of grinding which is fundamental to the system. In the vibrating mill, the upper limit to the frequency and amplitude of the imposed vibration is determined only by the stresses in the structure resulting from the angular acceleration, and experimental work has shown that the rate of grinding varies approximately with the cube of the frequency and the cube of the amplitude of the vibration. It follows, therefore, that very high rates of grinding are attainable with this system.

The Sturtevant mill, which is designed for continuous dry grinding of granular materials, is manufactured in a range of sizes varying from small laboratory machines—suitable also for pilot plant and small-scale industrial applications—to machines capable of reducing several tons per hour of hard feed material from a size of 12-16 mesh to a product of substantially sub-sieve fineness. The machines are mounted on resilient rubber suspension systems. The foundations are thus protected from the effects of high-frequency vibrations of relatively large amplitude.

To date, Sturtevant continuous feed vibratory ball mills are not made in the larger sizes, but the size range is being extended.

The feed must of necessity be finer than that to an orthodox rotating ball mill, but the output for a given floor area and horsepower is very much greater, and considerable economies can be shown in many varied applications.

The rate of wear of the grinding media and linings in vibratory mills is much less than in rotating ball mills, but since the Sturtevant mill is normally fitted with a rubber lining, which is cheap and easily replaceable, it is expected that the running and maintenance costs will be much less than conventional types of size reduction machinery.

Book Reviews

A Short History of Technology

From the earliest times to A.D. 1900. *By T. K. Derry and T. I. Williams. Clarendon Press, Oxford.* 1960. *Pp.* 782. *Illustrated.* 38*s. net* (*U.K. only*).

IN THE nineteenth century the writing of history was largely confined to politics and constitutions. Since then historians have broadened their interests to include social, economic and cultural aspects of the story of man. Science too has acquired its *corpus* of historians. But until I.C.I. undertook to sponsor the massive, five-volume *History of Technology*, little had been provided for students of technology and applied science. The publication of this great work was a tremendous success; even at 40 guineas a set it has sold in remarkably high numbers. Now I.C.I. have placed us all even more in their debt by sponsoring this *Short History of Technology*. Selling at less than £2, it is astonishingly good value and it certainly deserves to become a best seller.

It is based on the 4,400-page *History* and is thus an authoritative summary of the whole mighty field of technology. But it is not just an abridgement. The authors have provided much new material not found in the main *History* and have consulted many fresh sources. New illustrations have also been included.

The two authors are admirably qualified. Dr. Derry is an historian with a long experience of teaching and writing and Dr. Williams was managing editor of the later volumes of the main *History*; he is editor of I.C.I.'s international review *Endeavour* and a chemical historian in his own right.

They have related technology to history, so that the book is as much technological history as a history of technology. The text is divided into two parts: the first telling the story up to 1750—roughly the beginning of the Industrial Revolution—and the rest taking the story to 1900. They have stopped at the beginning of this century because they feel it is difficult to assess the true historical significance of recent developments and also because of the difficulty of explaining the complex inventions since then in the non-technical terms used in the book. We can sympathise with them here.

There are 24 chapters with titles such as "The Steam Engine," "Building Construction" and "Coal and the Metals." There are two chapters on the chemical industry; the first deals with the beginnings (before 1750) and the second with the rise of the modern chemical industry. At the end of the book there are chronological tables, a bibliography, an index of subjects and an index of persons and place names.

The book is a work of the highest scholarship and authority. Let us hope it inspires a companion history of technology in the first half of this century.

Chemical Encyclopædia

Lexique Technique des Produits Chimiques. 14*th ed. Annuaire Internationaux Rousset*, 31 *rue Deparcieux, Paris* 14e. 2 *vols. Pp.* 1,360. 80 *N.F.* (+5 *N.F. postage*). (*About* £6 10*s.*)

FOR those who know enough French this two-volume encyclopædia is a useful supplement to similar works in English. It gives information on about 7,200 elements, isotopes, chemicals and natural products, and references are freely made to preferred names from others. English and German names are given, the former reasonably correctly, but there is no index from them to the French terms used. The same information is not given about each product, even where applicable, but useful information, rare in comparable books, is given on packaging and purification.

It is difficult to make a work of this type accurate and to eliminate obsolete statements long given in text-books. For example, the information given for composition of natural waxes is generally quite out of date and yellow and white (bleached) beeswax are given quite different compositions. There is less justification for the statement that butter is made by churning milk! The physical constants which were checked were mostly correct.

No names of compilers or editors are given which would enable readers to judge the authority of the work, and as with other such works information given should be checked whenever correctness is important. It is a useful compilation and reasonably good value for money.

D. J. CAMPBELL.

Fundamentals of Chemical Engineering Operations

By M. G. Larian. Constable and Co. Ltd. 1960.

THE author is Professor of Chemical Engineering at Michigan State University. He has set out to produce a practical teaching book and it is fair to say that he has succeeded very well in this purpose. All through the text he attempts to start from the fundamental principles of the particular process concerned and only describe industrial plant for carrying it out in so far as it illustrates the fundamental principles. The usual American system of providing examples within a chapter where the solution is given, and also a set of questions at the end of the chapter, is followed. This tends to break up the natural flow of the material, but is obviously useful in teaching.

The book is divided into three parts, the first part, general principles, deals with units and dimensions, flow of fluids, heat transfer, evaporation, mass transfer, phase contactors, and simultaneous heat and mass transfer. As is usual in chemical engineering textbooks, heat transfer by radiation is dealt with rather briefly because it is not so important in most of the equipment concerned in what one might call classical chemical engineering. The second main section deals with separation of mixtures by interphase mass-transfer operations, that is, drying, distillation, liquid-liquid extraction, solid-liquid extraction and gas adsorption. In this section, as in the last one, there is bound to be more description of practical apparatus than in the first section, and a tendency to illustrate this by a few arrows showing what happens inside it rather than by fundamental differential equations. The third section occupies only 100 pages and deals with the mechanical separation of heterogeneous mixtures, that is, gravitational centrifugal methods and filtration.

It is surely significant that in a complete book dealing with the fundamentals of chemical engineering operations, there does not appear to be a single mention of a chemical reaction from beginning to end.

M. W. THRING.

Glaxo's N.H.S. sales decline

Increase in profits " not at Exchequer's expense "

ALTHOUGH trading conditions both at home and abroad have been highly competitive, the Glaxo group has succeeded in increasing its trading profits by more than 25%, the net profit after tax being £3,760,400. These results were given in the annual report by Sir Harry Jephcott, chairman, who said that the favourable outcome of the year's trading was mainly due to the promotion of new products throughout the world in both the human and veterinary fields.

N.H.S. trade. Only a very small proportion of turnover and profitability was derived from sales under the National Health Service. As the overseas markets had expanded, so the proportion of pharmaceuticals sold to the Health Service had dropped. Since the Health Service started 12 years ago wages had risen 70% and raw materials 20% but the price of the group's antibiotics and pharmaceutical preparations had not been increased. In fact most of the prices had been materially reduced and prices paid by the N.H.S. had fallen by 6½% p.a. The continuing profit of the Group (which includes Allen and Hanburys) has in no way been achieved at the expense of the Exchequer, declared Sir Harry.

Polio vaccine. Purchases of polio vaccine by the Ministry of Health were appreciably less than expected, and it is forecast that they will continue to decline because the backlog of persons requiring immunisation has now been eliminated.

Developments in the export market had mainly centred around griseofulvin, a new antibiotic for treating fungal infections of the skin, hair and nails. But political upheavals as far apart as Cuba and Indonesia disrupted markets.

Sheep vaccines. The report also outlines two aspects of immunological research that Glaxo is studying. During the past year a range of new vaccines giving protection against all the common clostridial infections of sheep have been completed; considerable headway has also been made with canine and equine vaccines. " The position is less satisfactory in human therapeutics," said Sir Harry. The greater the success, the greater is the danger that people will be lulled into a false sense of security. This affects not only producers, but also those concerned in the prevention of disease. There still remains a great need to educate the community to take full advantage of vaccination techniques.

Geigy subsidiary's new laboratory

The new laboratory building of James Anderson and Co. (Colours) Ltd., Hawkhead Road, Paisley, Scotland, was opened on November 2 by the Lord Polwarth, chairman of the executive committee, the Scottish Council (Development and Industry).

The building is a block of 11 laboratories used for pigment research and development work with chemists' offices, a library and conference room. The floor area is 12,000 sq. ft. and the total cost was £170,000.

Lord Polwarth was received and introduced by Mr. E. G. Turner, chairman, Geigy (Holdings) Ltd., and opened the door of the new building with a gold key presented by the architect. He and several parties of guests were then shown over the new building and the works.

James Anderson and Co. (Colours) Ltd. is one of the manufacturing companies of the Geigy group in Britain, and specialises in the production of organic pigment colours for the paint, printing ink, paper and plastics industries.

At luncheon afterwards in Paisley Town Hall Lord Polwarth proposed a toast to the President of the Swiss Confederation. Lord Polwarth was introduced by Mr. A. H. Whitaker, chairman James Anderson and Co., and Mr. C. A. Staehelin, director J. R. Geigy S.A. of Basle and director Geigy (Holdings) Ltd., spoke in reply.

Borax bid for Hardman and Holden

Borax (Holdings) have bid for the whole of the £750,000 issued share capital of Hardman and Holden, the Manchester firm of chemical manufacturers. The terms of the offer are two Borax deferred ordinary 5s. shares plus 20s. in cash for every three ordinary 5s. shares of Hardman and Holden. At the time of the bid it was worth 18s. 2d. a Hardman and Holden share against a market price of 15s. 6d. The board of Hardman and Holden have recommended the offer to their shareholders. This is the second step Borax has taken this year towards broadening its traditional business of boron and its compounds. In March it acquired a 55% interest in Spencer Chapman and Messel, general chemical manufacturers.

The new bid values Hardman and Holden at about £2,700,000. Net profits, which have been somewhat erratic in recent years, were £128,000 in the year ended last March.

Laporte buy mineral processes

Laporte Industries Ltd. have purchased from Head Wrightson and Co. Ltd. the whole of the issued capital of the Cupola Mining and Milling Co. Ltd. The Cupola company is engaged principally in the treatment of fluorspar and barytes and Laporte will expand production at the flotation plant at Stoney, Middleton, Derbyshire, which has recently been installed by Head Wrightson.

Flu and polio vaccines: Chief M.O.'s comments

Although influenza vaccination might be offered on a wide scale under the threat of an epidemic, such a course would not be justified as a regular preventive measure unless more effective vaccines are produced. This comment is made by the Chief Medical Officer of the Ministry of Health in his annual review. Speaking of polio vaccine, Sir John Charles said the national vaccination campaign was a magnificent achievement and that the vaccine continues to demonstrate its safety and efficacy.

T.B. Deaths from all forms of tuberculosis declined by 14% to 3,854 (in 1948 deaths totalled 21,993). Steady pressure on the disease may bring it under complete control.

Rheumatism. Progress in elucidating rheumatic diseases continues slow. Deaths are slowly descending in incidence.

Fluoridation. Eventually one-third of children aged 12-14 should be completely free of caries. There is no danger in fluoridating water supplies, but opposition continues to a small degree. Sir John Charles likens this opposition to that following the introduction of chlorination of water and pasteurisation of milk.

Cancer. Deaths totalled 97,117, the highest since 1947. Cancer registration is not complete and many years will be needed to get a true picture of cancer morbidity and what will be required to meet it.

V.D. There has been a serious increase in gonorrhœa. The overall figures in 1959 give no cause for complacency.

I.C.I. buy site in N. Ireland

I.C.I. have completed the purchase of some 200 acres of land at Kilroot, near Carrickfergus, County Antrim, as a site for a factory for the manufacture of *Terylene* and possibly other man-made fibres.

The new Esso refinery at Milford Haven which was opened recently by the Duke of Edinburgh, has been designed to process initially 4½ million tons of crude oil p.a. with a staff of 330. The cost of construction was approximately £18 million.

There are four principal refining units: the primary crude oil distillation and light-ends recovery unit which physically separates the principal ingredients of the crude oil; the Powerformer which converts low octane naphtha from the distillation process into high octane motor spirit; the copper sweetening unit which removes certain unwanted compounds from both petrol and jet fuel and the Hydrofiner which removes sulphur from gas and diesel oils.

A feature of the refinery is that only air is used for the final cooling of hot products, which considerably reduces the possibility of pollution. There is a very high degree of automation. All units are automatically controlled from one central control room. At a second control room the liquid level and temperature of every tank in the refinery is electronically recorded.

Benzole hydrorefining unit

The new benzole refinery of Port Talbot Chemical Co. Ltd. (controlled by Steel Co. of Wales Ltd. and Lincolnshire Chemical Co. Ltd.) at Port Talbot has started production ahead of schedule. Already a pure benzene of over 5·40 crystallising point has been obtained, with a sulphur content of below 5 p.p.m. Toluene, xylene and naphthas are all of similar low sulphur content, exceptionally colour stable and highly aromatic. The crude benzole and coke oven gas (which provides the source of hydrogen) are derived from the coke ovens of the Steel Co. of Wales, and the plant is the first of its kind in this country to produce pure benzene by hydrorefining.

New benzene and toluene plant

British Celanese Ltd. will produce nitration grades of benzene and toluene, and 3° xylene at a new aromatics condensate separation unit at their chemical works at Spondon, Derbyshire.

The unit is being designed and erected by the A.P.V. Co., and will incorporate a cyclopentadiene recovery unit operating according to British Celanese process design. The plant is expected to come on stream in August 1961.

I.C.I. raise capacities of HOC division plants

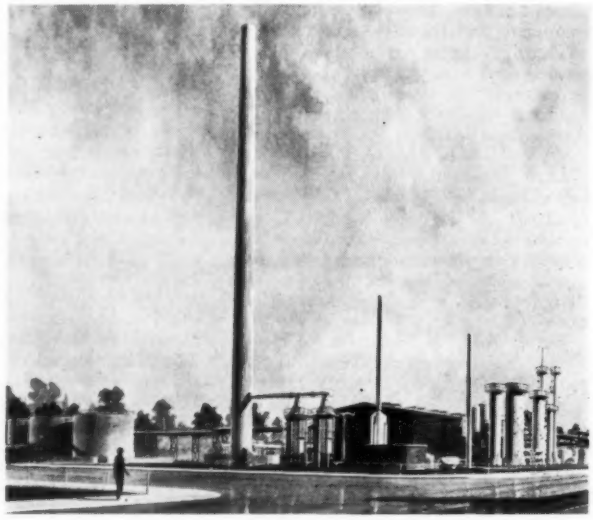
Many of the Tees-side plants of I.C.I. at Wilton and Billingham are currently being modified to obtain substantially greater outputs.

Manufacturing capacity for high-purity ethylene from the three olefine plants at Wilton is now being stepped up from 120,000 ton/p.a. to about 140,000 ton/p.a.; there will be corresponding increases of the other products of these plants.

The capacity of the acetone plant at Billingham is now being expanded from about 28,000 ton/p.a. to 36,000 ton by mid-1961. Following expansion in production of phenol at Billingham, new equipment is being installed in the phenol by-products plant complex to raise the combined production of *Topane* and para-phenylphenol from 650 ton/p.a. to 1,000 ton/p.a. by the end of 1961. "Topano" is I.C.I.'s brand of ortho-phenylphenol and an efficient disinfectant and preservative. Para-phenylphenol is an intermediate in surface coating resin production.

The two para-xylene plants at Wilton are being modified to give higher capacity. Para-xylene is one of the two major raw materials for "Terylene" manufacture.

In the meantime, rapid progress is being made with Heavy Organic Chemicals Division's new plants at Severnside, South Gloucestershire, for 35,000 ton/p.a. of ethylene oxide, ethylene glycol and associated products. Ethylene oxide will be produced by the direct air oxidation of ethylene supplied by pipeline from Esso's Fawley refinery.



An artist's impression of what I.C.I.'s new plants for the manufacture of ethylene oxide, ethylene glycol and associated products will look like at the Severnside site, Gloucestershire, by the end of 1961.

J. L. Fletcher

A. T. Bond

Dr. M. Josephs

T. C. Black

J. L. Fletcher has been appointed manager of the General Chemicals Division, Cyanamid of Great Britain Ltd. Mr. Fletcher, who was previously connected with the paint and plastics industries, will be responsible for bulk sales of chemical products in the United Kingdom which will include melamine crystal production from the new Gosport plant. He is now visiting American Cyanamid Co. in the United States and will return to London in mid-December.

The dyestuffs committee of the A.B.C.M. have appointed **Harold Blackshaw,** now retired after 40 years' service with I.C.I. (Dyestuffs Division) and its predecessors, to succeed **F. Scholefield** as technical dyestuffs adviser. He started his new duties at the Dyestuffs Office, Board of Trade, Manchester, on November 28. Mr. Blackshaw is known for his work on the Second Colour Index, for which he received the Gold Medal of the Society of Dyers and Colourists.

T. C. Black, general manager of the Ames Co. division of Miles Laboratories Ltd. since March 1959, has been appointed to the Board of Miles Laboratories Ltd. Born in Melbourne and educated in England, Mr. Black spent 27 years with Menley and James Ltd., during which he had experience in every department of the company. In 1956 he joined Pfizer Ltd. as commercial development manager.

The Davy Medal of the Royal Society has been awarded to **Prof. J. M. Robertson,** F.R.S., Gardiner Professor of chemistry and administrative head of the chemical laboratories in the University of Glasgow, for his pioneering work on analysis of crystal structure, especially of organic compounds.

A. E. Richards has been appointed managing director of Universal Matthey Products Ltd., the joint subsidiary company of Universal Oil Products Co. and Johnson, Matthey and Co. Ltd. formed in 1953 to meet the needs of the petroleum and petrochemical industries for catalysts.

C. G. Andrews, chief glassblower at the National Chemical Laboratory, has been awarded the British Empire Medal, receiving it from Lord Hailsham, Minister of Science. Mr. Andrews has been chief glassblower for 13 years and has made a major contribution to many of the Laboratory's researches. He has been in charge of training of young glassblowers for the National Physical Laboratory as well as N.C.L. Many of his pupils now occupy key positions in Government service and industry. Mr. Andrews, 58, lives at Hanworth, Middlesex. He is married and has two daughters.

Prof. E. E. Turner has joined the board of Biorex Laboratories Ltd. The company has now acquired Apsley House, 198 City Road, E.C.1, where it is moving its research division; the removal of the departments of chemistry, pharmaceutical chemistry, and pharmaceutics, led by Prof. Turner is now nearly complete.

The board of Evans Medical Ltd., Liverpool, have appointed **Frederick Morrice** secretary of the company in succession to the late Laurence Chrimes.

A. D. Campbell, controller of supplies at the Ministry of Health, retired on November 2. His successor is **J. F. Hunt,** an assistant secretary in the Ministry. Mr. Campbell, who is 62, qualified as a pharmaceutical chemist in 1923. He joined the War Office in 1925 as assistant inspector of medical supplies. After service with other Ministries he transferred to the Ministry of Health and in 1957 became controller of supplies.

Dr. Albert Wettstein, head of the Biological Research of Ciba Ltd., Basle, has been awarded the 1959 prize of the Marcel Benoist Foundation. The prize, which is awarded annually, is given to the Swiss scientist who has made the most useful contribution to human life during the preceding year. Dr. Wettstein received this high distinction for his outstanding work in the field of steroid hormones.

R. A. Withers has decided, while continuing in his full-time executive capacity as deputy chairman of the Board of Ilford Ltd., to relinquish his appointment as joint managing director. **James Mitchell,** the present sales director, has been appointed to succeed Mr. Withers as joint managing director with **W. H. Dimsdale.**

To further their developing interest in oleo-chemicals, Price's (Bromborough) Ltd. have recently created a new post in their sales department—market research manager—which will be filled by **Dr. M. Josephs.** From 1948 to 1955 Dr. Josephs was at Bristol University and after graduating carried out research in heterogeneous catalysis. In 1955 he joined the research department of Unilever Ltd., working on synthetic detergents. From 1957 to 1960 he was with John Knight Ltd. of Silvertown as research and development manager. His work there covered the field of glues, adhesives and fats.

Cdr. A. T. Bond, R.N. (RTD.), has been appointed director of sales for P. Leiner and Sons (Wales) Ltd. Mr. Bond joined the company 12 years ago as assistant to the general manager at the Treforest factory, Glamorgan.

Hans Stauffer, president of the Stauffer Chemical Co., U.S.A., has been awarded the gold medal of the American Society of Chemical Industry for his achievements in the industry.

R. Halstead, M.A., B.SC., A.R.I.C., at present director and vice-president (production) of Beecham Products Inc., the Group subsidiary in U.S.A., is to be appointed assistant managing director of Beecham Research Laboratories Ltd.

Obituary

We regret to announce the death of **W. J. Piggott,** a former director of Laporte Industries Ltd.

Mr. Piggott joined the company in 1907, in the time of its founder, Mr. Bernard Laporte. He was appointed secretary of B. Laporte Ltd., as the company was then known, in 1922 and a director in 1944. He retired from executive office in 1956, after nearly 50 years, during which he devoted much time to the commercial affairs of the company. In 1959 he retired from the board. Mr. Piggott, who lived all his life in Luton, was 67.

MEETINGS

Society of Instrument Technology

December 15. "Instrumentation in steelmaking," by N. P. Bacon. 7 p.m. The Blossoms Hotel, Chester.

January 6. "Electronics and instrumentation in the glass industry," by J. R. Beattie. 5.30 p.m. Administration Bldg., Esso Refinery, Fawley.

January 11. Visit to the British Iron and Steel Research Association, followed by "The Tallimarker—an information handling scheme for processing lines" by W. L. Marks and D. J. Mayes. 6 p.m. at B.I.S.R.A.

Society for Applied Bacteriology

January 11. "Quantitative Microbiology," joint meeting with Microbiology Group, S.C.I. 2.15 p.m. Barnes Hall, Royal Society of Medicine, 1 Wimpole Street, London.

Chemical Society

December 13. "Catalytic mechanisms of hydrolytic enzymes," by D. T. Elmore. 7.15 p.m. Chemistry Department, David Keir Bldg., Queen's University, Belfast.

December 14. "Rocket propulsion," by C. H. Johnson. 8 p.m. Robert Gordon's Technical College, Aberdeen.

January 12. "The analysis of plastics," by J. Haslam. 6.30 p.m. Department of Chemistry, University of Bristol.

January 12. "Some problems in the chemistry of the Gallotannins," by R. D. Haworth. 7.30 p.m. Lecture Theatre, Royal Institution, Albemarle Street, W.1.

January 12. "Chemistry and brewing—a new outlook," by A. H. Cook. 7.30 p.m. Heriot-Watt College, Edinburgh.

Society of Chemical Industry

January 2. "Financial management in the chemical industry," by H. F. Corsan. 6.30 p.m. 14 Belgrave Square, London, S.W.1.

January 6. Film evening. "The Griseofulvin story," "Journey into the Weald of Kent," "Glass," "A Light in Nature," and "Hazard." 6.30 p.m. Royal Commonwealth Society, 18 Northumberland Avenue, London, W.C.2.

Chemical Engineering Group

January 10. "Some industrial uses of plastics," by G. A. Rawcliffe and T. Love. 6 p.m. S.C.I., 14 Belgrave Square, S.W.1.

Corrosion Group

January 4. Cathodic protection panel meeting and discussion on galvanic anodes. 6 p.m. 14 Belgrave Square, London, S.W.1.

Institution of Chemical Engineers

January 10. "Selection of prime movers in the petroleum chemical industry," by H. H. Meyer. 6.30 p.m. Chemical Engineering Lecture Theatre, Manchester College of Science and Technology, Jackson Street, Manchester.

THE CHEMICAL MARKET

This Month's Changes

LONDON.—Prices have remained stable this month. Gums and waxes, which normally fluctuate, have not changed from last month except **agar agar No. 1** (powder) which is up 1s. 6d. to 22s. 6d. lb.

Due to increases in the price of raw materials **diethyl** and **dimethyl phthalates** have both risen. **Diethyl** is up £13 10s. to £201 ton and **dimethyl** is up £15 to £194 ton.

Silver nitrate has dropped considerably by 1s. to 4s. 1⅜d. oz.

Quinine sulphate is now 2s. 11½d. oz.

Zinc oxide is also down by £2 10s. to £110 ton.

The three main mineral acids still hold their prices. These are: **hydrochloric acid** (commercial) 18s. 6d. cwt., **nitric acid** (70% intermediate) £36 ton, and **sulphuric acid,** ex-works, according to quality and quantity from 8s. to 10s. cwt. (B.O.V. 78%) and from 11s. to 14s. (C.O.V. 96%).

Chilean crude iodine (99% min. in wooden casks) remains the same price at 17s. 4d. kg.

Royal Institute of Chemistry

December 13. "Photography in scientific research," by K. G. Moreman. 7 p.m. The Old Palace, Maidstone.

January 10. "Science and archæological investigation," by H. M. W. Hodges. 7 p.m. Technical College, Mayfield Hall Annexe, Pelham Road, Gravesend.

Society for Analytical Chemistry

December 15. "The development of the analytical balance," by K. M. Ogden. 7 p.m. Technical College, Nottingham.

January 10. "Polarography for trace analysis," by B. Lamb. 7 p.m. Technical College, Wolverhampton.

January 12. A.G.M. and "Polarography." Bristol.

Cosmetic chemists honour British chemist

The 1960 Medal Award of the Society of Cosmetic Chemists has been bestowed upon Dr. Robert Henry Marriott, who has just retired as Director of Products Research, County Laboratories Ltd., Brentford, Middlesex, for his contributions in chemical research in the cosmetic industry and in the leather trades.

Dr. Marriott's work has continued uninterrupted for almost 30 years, during which time he was twice President of the Society of Cosmetic Chemists of Great Britain. He was one of the first scientists to work in cosmetic rheology and helped plan the international congress on hair held in London two years ago. He also organised the first British Congress of Cosmetic Science in London. Dr. Marriott was elected the second president of the International Federation of Societies of Cosmetic Chemists to serve until August 1961.

His graduation with honours as a B.Sc. of the University of his native Leeds in 1921 was followed by the M.Sc. in 1922 and a Doctorate ten years later. During this time he was a member of the research staff of the British Leather Manufacturers' Research Association. From 1936 to 1938 he was President of the Society of Leather Trades' Chemists.

How to get chemical information

A comprehensive account of how to use information services was given by Mr. C. W. Hanson, B.SC., of the Association of Special Libraries and Information Bureaux (Aslib), to members of the Society of Cosmetic Chemists at a recent meeting.

The lecturer stated that a survey had shown that chemists spent only 36% of their working time in practical work, 45% of it was passed in giving or receiving information, most of it orally. The need for information was, therefore, impressive.

The output of published work was colossal. The chemist did not normally spend more than one hour a day reading technical literature. He therefore read no more than 220 papers a year in his working time. It was clearly not possible to read all the papers on a specialist subject, hence the need for information service.

The information service in its most advanced form would search the appropriate literature, study and assess it, and issue the chemist with a memorandum on the subject. The reliability of this would depend upon the knowledge, experience and qualifications of the staff.

The lecturer then outlined the library facilities available and said that all laboratories should have at least a rudimentary library.

The Patent Office Library, the Science Museum Library, and the libraries of the learned and professional institutions all offered excellent facilities. There were good scientific sections in some Public Libraries, particularly in the provinces. University and Technical College librarians were often helpful if courteously approached, even though the chemist was not a member. Other facilities were provided by the National Chemical Laboratory at Teddington, by Trade Associations, by H. K. Lewis and Co. Ltd., Gower Street (no time limit so long as the subscription is paid), the technical trade press and Aslib. The Aslib directory listed 3,300 specialist organisations which were sources of organised knowledge.

Information services, as such, were very few and very costly. The lecturer concluded by giving a few hints to the seeker after information: to give full references; to reveal his position, specialist or novice; to be precise in his requests.

Vintage stock—a 30-year-old tin of Bemax being opened and tasted by the managing director of Vitamins Ltd., Mr. H. C. H. Graves, at their annual sales conference dinner. The contents was found to be still in good condition.

Two new Marchon ships

At a luncheon given to mark the retirement, after fifty years' service, of Captain J. Coupland, the first master of the *Marchon Trader*, Mr. Schon, chairman and managing director of Marchon Products Ltd., announced that an order for two more Marchon ships, each with a carrying capacity similar to that of the *Marchon Trader*, approximately 2,300 tons, had been placed with Clelands of Wallsend-on-Tyne. Improvements based on the experience gained with the *Marchon Trader*, carrying phosphate rock from Casablanca to Whitehaven, have been incorporated in the design of these two ships.

I.C.I. factory to close

I.C.I.'s Alkali Division announces with regret that its factory at Silvertown, near London, will be shut down at the end of March 1961.

Silvertown Works produces washing soda (or soda crystals) which the Division also produces in a large plant at Winnington in mid-Cheshire. With the recent advance of modern synthetic detergents the demand for washing soda has now declined to a point where it is more economic to concentrate manufacture at Winnington, where there is better access to the necessary raw materials and services. Continuity of supply of I.C.I. washing soda to all customers is fully assured.

Silvertown Works also acts as a depot for other I.C.I. alkali products for customers in the London area; alternative arrangements are being made to maintain the prompt delivery service.

About 140 I.C.I. employees are affected. Some will be transferred to other jobs within the company. Those that have to be discharged will be treated under the normal I.C.I. arrangements for redundancy

Silvertown Works of Brunner, Mond and Co. was built in 1894 to make washing soda from soda ash brought from mid-Cheshire. A year later a caustic soda plant was erected using raw material from the same source, but just before the first World War caustic soda manufacture was concentrated at Winnington. During the first World War at the request of the Government the disused caustic plant at Silvertown was adapted as an emergency measure for purifying T.N.T. until new, specially designed, factories could be built. The plant at Silvertown was destroyed in a fire followed by a disastrous explosion in January 1917. The Works was rebuilt and continued, later under I.C.I., to manufacture washing soda. It received only slight damage in the last War.

New P_2O_5 plants

W. J. Fraser and Co. Ltd. have in hand two complete phosphoric acid units for new U.K. fertiliser projects. Each plant has a design annual capacity of 1,500 tons P_2O_5 in the form of 30% phosphoric acid. The installations will incorporate the single reaction-tank process, developed jointly by Union Chimique Belge (U.C.B.) and Compagnie de St. Gobain, for which Frasers hold U.K. and Commonwealth rights.

Essence makers elect new chairman

Eric L. Bush (chairman of W. J. Bush and Co. Ltd.) has been elected chairman of the British Essence Manufacturers' Association and of the Essence Export Group in succession to Mr. F. G. Pentecost (A. Boake Roberts and Co. Ltd.), who has been vice-chairman since 1949 and chairman since 1954 of the two organisations. At a luncheon given in Mr. Pentecost's honour, the executive committees of the two organisations paid tribute to his outstanding services to the industry and presented him with an oil painting as a token of their respect and esteem.

Mr. R. D. F. Marlow, D.S.C., has been appointed assistant director-general of the Institute of Directors and has resigned from the secretaryships of the British Aromatic Compound Manufacturers' Association, the British Essence Manufacturers' Association and the Essence Export Group. He is succeeded by Mr. F. T. Atkins, who will also take over Mr. Marlow's executive responsibilities in connection with the Essential Oil Importers' Section of the London Chamber of Commerce.

D.C.L. Chemical's overseas division

The Distillers Co. Ltd., Chemical Group, has set up an overseas division. Dr. H. K. Whalley, formerly division director in charge of development, will head the overseas division, and will be assisted by Mr. P. L. Bramwyche.

In Australia, D.C.L. has a 40% interest in C.S.R. Chemicals (Pty.) Ltd., Sydney, owned in partnership with the Colonial Sugar Refining Co. Ltd., one of Australia's foremost industrial concerns. This company makes organic chemicals and plastics, mainly from local raw materials.

In South Africa, D.C.L. has an interest of just under 50% in National Chemical Products Ltd., Germiston, Transvaal.

Instrument makers' new branch

Negretti and Zambra have opened a new branch in Newcastle on Tyne. It will consist of a technical sales office, service depot, supplies depot and also a retail shop.

Company finance

Evans Medical Ltd. have declared an interim dividend for the year ending December 31, 1960, of 3d. (2¼d.) per 5s. ordinary stock unit less income tax.

Beecham Group Ltd. have declared a first interim dividend of 8% less tax on the ordinary shares on account of the year ending March 31, 1961.

Unilever Ltd., and Unilever N.V. have declared interim dividends on their respective ordinary capitals on account of the year ending December 31 1960, at the following rates:

Unilever Ltd.—1s. 9·7d. actual per £1 of stock before tax (1s. 7·2d.).

Unilever N.V.—F1.8 actual per F1.100 of capital (F1.7), being the equivalent of the Unilever Ltd. dividend.

Laboratory centrifuges

Enquiries for the *Dynacone* stainless steel continuous centrifuge should be addressed to International Combustion Products Ltd. and not Riley (I.C.) Products Ltd. as stated in the October laboratory equipment review.

Fluoride toothpaste

Procter and Gamble, who have carried out extensive research for 20 years into the effectiveness of fluorides to combat caries, have introduced a new toothpaste named *Crest* containing a small amount of stannous fluoride. After seven clinical trials over a period of years in the United States, the American Dental Association has authorised the company to state in its advertisements that this toothpaste has been shown to be an effective anti-caries dentifrice of significant value when used regularly.

This is probably the first time that a professional scientific body has endorsed a commercial product as being of special value in the prevention of disease. The British Dental Association are to allow this endorsement to be used when the toothpaste is marketed in this country by Thomas Hedley, Procter and Gamble's subsidiary.

Weight reducer

A new weight reducing product which it is claimed, supplies a nutritionally balanced, hunger satisfying, 900 cal./day diet has been introduced in Britain by Mead Johnson Ltd.

The product, called *Metercal* was developed by Mead Johnson and Co. (U.S.A.) *Metercal* is said to achieve effective weight loss, provide optimum nutrition with minimum calories and satisfy hunger. It contains no drugs.

The product is described as blending essential nutrients—protein, carbohydrate, fat, vitamins, and minerals—in powder form. Dissolved in water, the powder makes a beverage, four glasses of which constitute a full day's diet. It can be used to replace one or more meals a day. It is available in three flavours, chocolate, orange and vanilla, and retails at 8s. 6d.

Paint reodorisers

After research into the problem of reodorising paints and other coating materials, Standard Synthetics Ltd., claim to have developed several masking agents.

One of these products is Industrial Deodoriser 183. It is a compound of aromatic chemicals and essential oils. It has been found to be successful in practical tests when used in very small concentrations, namely: 1 part in 3,000 in undercoat and primer, and 1 part in 2,000 in gloss coat.

Industrial Deodoriser 183 does not only mask the volatile solvent odours, but it contains high-boiling constituents which continue to impart a pleasant odour while the paint dries and oxidises.

Some new resin bases for use in coating products, *i.e.* acrylic resins, have very pungent, unpleasant odours. For these, a masking agent of different characteristics has been developed, Industrial Deodoriser 523.

Owing to the stronger odour to be masked, this material has to be used in higher concentrations. 1 part in 200 is suggested. These and other compounds, made to customers' requirements, are reasonably priced and economical to use.

Insecticide odorants

Dodge and Olcott, New York, have developed new odorants known as *Malamasques* to improve the odour of malathion in a variety of products, including insecticides, flea sprays and powders, aerosol garden sprays, etc.

New dyeing agent

Dispersol CWL, a new dyeing assistant that widens the scope of the fast wool dyes, has been announced by I.C.I. dyestuffs division.

The product is a pale fawn mobile liquid, essentially non-ionic, which functions by slowing down the rate of dyeing of acid milling dyes of the Carbolan and Coomassie types. Many of these, such as Carbolan Violet 2R, that have hitherto been considered unsuitable for level application to wool yarns, can now be applied satisfactorily it is claimed. Others, including the majority of the Carbolans, can be applied at a higher initial dyeing temperature.

Anabolic steroid

I.C.I. Ltd., have introduced *Anapolon*, an entirely new anabolic agent originating from the Syntex Corp. and manufactured in Great Britain by I.C.I.

Anaplon (17β-hydroxy - 2 - hydroxymethylene - 17α - methylandrostan - 3 - one) is distinguished by its ability to promote the retention of nitrogen and other elements essential for tissue building. It restores the metabolic balance and facilitates recovery in cases of febrile or wasting disease, impaired development in children, surgical procedures, burns and other injuries.

Presented in scored tablets of 5 mg. in containers of 25, basic N.H.S. cost, 19s. and 100, basic N.H.S. cost, 70s.

Dosage: 5-15 mg. per day for periods of 30-45 days with breaks of 10-15 days without medication between each course. Higher doses are recommended in cases of serious malnutrition, etc.

Topical aerosol for skin treatment

Merck Sharp and Dohme Ltd. are now marketing *Decaspray*, an aerosol spray of dexamethasone and neomycin sulphate. It is offered as a treatment for a wide range of inflammatory and pruritic skin conditions. A unique feature of the aerosol pack is the controlled delivery of the steroid and antibiotic, at whatever angle the container is held.

Each spray pack contains 10 mg. of dexamethasone and 50 mg. of neomycin sulphate. Retails at 22s. 6d.

Bronchial relief

Burroughs Wellcome and Co. have marketed two more *Actifed* products.

One is Actifed Compound Linctus, which is indicated for the relief of coughs, especially when associated with respiratory or nasal congestion. Containing codeine phosphate as well as the antihistamine, triprolidine hydrochloride (Actidil), and the bronchodilator and vasoconstrictor pseudoephedrine hydrochloride, this linctus is valuable in treating coughs, with or without the common cold, and in allergic asthma and bronchitis.

The other product, Actifed Syrup, is a new presentation of Actifed Tablets, especially formulated for children. Like the tablets, it contains triprolidine hydrochloride and pseudoephedrine. It is indicated in the treatment of nasal and respiratory congestion, and is useful for young bronchial asthmatics.

Actifed Compound Linctus and Actifed Syrup are available in bottles of 4 fl. oz. (6s.) and 20 fl. oz. (25s.).

Change of Tropenal formula

Vitamins Ltd. have, after experience with their preparation *Tropenal*, increased the concentration of phenobarbitone from $\frac{1}{4}$ to $\frac{1}{3}$ grain per tablet. The price remains unchanged.

Night Tan with sunscreen

A new formulation that produces a tan with or without exposure to the sun has been introduced as *Night Tan Sunscreen* by Ellanby Laboratories, part of the Lewis and Burroughs pharmaceutical group. Instead of being formulated as a lotion in an alcohol base, the new product is a cream. It is claimed that it is easier to apply and that the skin tone change is less startling. It incorporates a sunscreen and is thus suitable for beach use. A non-sun tan can be produced in $3\frac{1}{2}$ hr. it is claimed. The product retails at 17s. 9d., which is 7s. 3d. less than Ellanby's *Night Tan* lotion.

Ecomytrin cream

There has been some confusion in the trade concerning the description of this product made by Warner and Co. Ltd. Originally it was launched as Ecomytrin Ointment but later it was changed to Ecomytrin Cream as being more accurately descriptive of the base. There is, in fact, no change in the constitution of the product at all. It will now be known as Ecomytrin Cream only.

Rigidex kerosine containers

Over 200 containers blow-moulded in Rigidex high density polyethylene by Lacrinoid Products Ltd. have been supplied to the British Petroleum Co. Ltd. for transporting and storing kerosine to be used during the Himalayan Scientific and Mountain Expedition led by Sir Edmund Hillary.

The containers have been chosen by B.P., who are providing all the fuel and lubricants, and they have been extensively tested for performance at low temperatures and high altitudes.

Two hundred 2-gal. containers and 20 1-gal. containers will be used. They are light in weight, rigid and compact, and are virtually unbreakable, even at very low temperatures. They are more pleasant to handle than metal containers, being warmer to the touch and having no rough edges. They are completely resistant to corrosion. The containers are fitted with non-spluttering detachable pourers, now standard on all the *Handycan* containers made by Lacrinoid.

Rigidex polyethylene is made by British Resin Products Ltd.

Fibreboard polythene container

Following on the recent announcement that the Reed Paper Group has entered the plastic packaging field, Reed Corrugated Cases Ltd. is now marketing a new non-returnable corrugated fibreboard-clad polythene container. Designed for the carriage of a wide range of liquid and powder products, the container eliminates the need for returned container turn round systems and the associated accounting routines.

The new product is a composite container in which the corrosion-resistant polythene inner vessel is held in a specially designed patented carrier of corrugated fibreboard complete with separate carrying and pouring grips. The whole unit is fitted into a normal one-piece fibreboard outer transit case.

Great strength and rigidity are notable features of the pack, which gives four thicknesses of heavy board at the top and base and double thickness on the four walls.

The light-weight, thin walled polythene vessel is manufactured by Reed Plastic Packaging Ltd. Its integral screw-necked filling and pouring aperture has been designed to avoid spillage when dispensing even very small quantities of the contents. Screw caps giving a re-sealable closure are of high density polythene incorporating a flange giving a positive, leak-proof seal.

A 5-gal. container is immediately available and shortly a range of sizes, including some for export purposes, will be introduced.

The Railway Clearing House has approved the container for goods classified by them as non-dangerous. For the rail carriage of dangerous goods, full information must be submitted so that the need for tests can be considered.

The new fibreboard polythene container for liquids and loose powders.

Handycans made by Lacrinoid Products Ltd. from Rigidex polythene were chosen by the British Petroleum Co. to carry the kerosine used by the 1960 Himalayan Expedition led by Sir Edmund Hillary.

Ralsin for expedition use

Bags of transparent film will be exposed to extreme weather conditions on the Patagonian ice cap this year, when they are to be used to protect food for Eric Shipton's latest expedition. The packaging material chosen is *Ralsin*, the high-tensile strength film manufactured by Whiffen and Sons Ltd. The film, which is claimed to remain flexible at temperatures as low as —45°C. in deep freeze, will have to withstand severe climatic conditions without extra protection. The manufacturers make it available as a flat film and as tubular lay flat film in thicknesses ranging from 0·0012 to 0·04 in.

A new range of men's toiletries, called Mark Vardy, has been launched by County Laboratories Ltd. It consists of pre-electric shave lotion, after shave lotion, aerosol cream foam shave, talc in puffer pack and deodorant cologne in a squeeze pack. All products except the cream foam shave are cartoned.

Oblivon-C container

Universal Metal Products Ltd. are making screw cap containers for British Schering for their Oblivon-C ovets.

The distinctive feature of this container, which is in aluminium and holds 100 ovets, is that the aluminium cap is lacquered in the same colour as the main decoration on the can, which is green; the background is white, with the smaller lettering in black. The cap also bears the British Schering trade mark.

Rubber drum

Hycar synthetic rubber has been used by Fireproof Tanks to produce a 50-gal. drum which, it is claimed, can be bounced off a lorry without damage.

Made of Hycar-coated and impregnated rayon, the drum is designed for transport of liquid synthetic resins, and can be folded when empty. The problem of corrosion and the resultant contamination of contents does not arise, says the maker, and the ¼ in. thick walls reduce the risk of bursting. British Geon is the manufacturer of Hycar synthetic rubber.

News from Abroad

UNITED STATES

Detergent removal from waste water

A potentially cheap ion-exchange method for removing detergents from waste water has been reported by the American Chemical Society.

One of the ingredients of detergents, the alkyl benzene sulphonate materials, resists most disposal methods. But when waste water is passed through a column containing a plastic-like material called Duolite, most of the detergent is exchanged for a harmless substance. The present difficulty is to regenerate the Duolite. If an inexpensive method can be found, this may be an easy and economical way of keeping detergents from getting into surface water.

Colgate research centre

Mr. H. Lesch, president of the Colgate-Palmolive Co., has announced the start of construction of a multi-million dollar research centre adjacent to the Rutgers University Science Campus near New Brunswick, New Jersey. It will cover more than 200,000 sq. ft., with provision for future expansion. It is being constructed on a 75-acre tract in Piscataway Township overlooking the Raritan River and New Brunswick.

When completed in the spring of 1962, the building will house the Colgate-Palmolive scientists working in such fields as biology, oral health, pharmacology, biochemistry, physiology, enzymology and bacteriology. Much of the company's long-range, fundamental studies will be undertaken there—as well as part of its product development work.

The two-storey building will have a glass, ceramic, and aluminium exterior with a frontage of 360 ft. There will be two main laboratory wings extending to the rear, each 250 ft. long.

Shipping cuts chemical transport costs

The Dow Chemical Co.'s second large-capacity chemicals tanker has been launched. The new ship is named after Dr. Leland I. Doan, president of Dow. It is of an equivalent size to an 18,000-ton oil tanker, with an overall length of 551 ft., breadth of 68 ft. and speed of about 15 knots.

The *Leland I. Doan* features some special equipment:

Inner bottoms through the central cargo tanks and cofferdams between adjacent tanks carrying different products.

Separate pumps and pipelines for each cargo system.

Eight tanks of nickel-clad steel with nickel pumps and pipelines and coils.

Extensive tank cleaning facilities, including a large supply of dry air to dry tanks before loading or to maintain a dry air blanket on hygroscopic products.

The ship will have an improved system of cathodic protection by magnesium anodes, based on 13 years' operating experience with the *Marine Chemist* and the *Marine Dow-Chem*. A total of 184 plastic-coated anodes, each weighing 44 lb., will be welded to the hull of the new ship. Sixteen of the anodes will be placed at the stern and rudder area, where corrosion is normally severe. The others will be placed in 12 strings—six on each side of the hull. They will be coated with four types of plastics, the best of 150 types of coatings and applications evaluated in the laboratory. The wing tanks will have standard-type corrosion protection by 73-lb. magnesium anodes.

Dow was the pioneer in water transport of bulk chemicals. Today, Dow ships a greater variety of chemicals in bulk by water than any firm. Dow assisted in the design of the first inland waterways barges ever to be built for bulk transport of hydrochloric acid and was the first to ship hydrochloric acid in this manner. It was also the first company to make waterborne shipments of carbon tetrachloride, chloroform, methylene chloride, ethylene dichloride and styrene.

The chemical industry is faced with the necessity of shipping large quantities of products at minimum costs—the vast majority of chemicals go to the market at prices measured in pennies per pound. The low cost of shipping large quantities over great distances explains the increase in the water transportation of chemicals in recent years. It is in this efficient, economical bulk movement of high-quality chemicals by water that Dow has taken a leading and pioneering rôle. The launching of the S.S. *Leland I. Doan* is another step forward.

HOLLAND

New oleochemicals process

Unilever-Emery N.V. has started commercial operations in a new oleochemicals polymerisation unit at Gouda. The equipment has been under construction for the past year at the KSKF Gouda-Apollo factory, now a subsidiary of Unilever-Emery. Gouda-Apollo will supply raw materials and auxiliary services needed for the operation of the unit.

The process was developed by Emery Industries of Cincinnati, Ohio. Initially the Gouda plant will manufacture two polyfunctional carboxylic acids formerly marketed under the trade name Empol. These products, also known as dimer acids and di-linoleic acids, are widely used as chemical intermediates for the manufacture of polyamide resins, polyurethane foams, alkyd resins and corrosion inhibitors.

Link with U.S. manufacturer

The Pennsalt Chemicals Corpn. of Philadelphia, U.S.A., manufacturers of chlorine, caustic soda, fluorine compounds, alkylamines and derivatives, and aliphatic sulphur compounds, is to acquire a considerable interest in the expanding N.V. Fabriek van Chemische Producten Vondelingenplaat, Rotterdam, which produces dyes, intermediates, plant protectants, formic acid, oxalic acid, cellulose acetate foils and rubber chemicals.

The Dutch plant will manufacture a number of Pennsalt products and the experience of the Dutch plant will be used by Pennsalt in the U.S.A., Mexico and Canada.

The first project planned is a plant in Holland for tertiary dodecyl mercaptan and similar products used in the production of synthetic rubber. In addition, the Netherlands company's production of dyes, oxalic acid and synthetic foils will be increased. The first investments are expected to total more than $2 million.

NYASALAND

Essential oils industry

Barclays Bank D.C.O. reports that enquiries have been instituted by the Division of Natural Resources into the possibility of establishing an essential oils industry, following the claim by a visiting ecologist that Nyasaland had great potential for the cultivation of aromatic plants.

AUSTRALIA

Beauty by the ton

Australians are buying beauty aids by the ton, according to the Commonwealth Statistics Bureau. In the year to June 30, Australian factories produced 1,880 tons of talcum powder valued at £951,000; 112 tons of face powder, £536,000; 1,063 tons creams and lotions, £1,828,000; 1,511 tons of hair fixatives, £1,407,000; and 53 tons of lipstick, £972,000.

The pharmaceutical and toilet preparations industry also manufactured patent medicines valued at £23 million; toothpaste, £3 million; and veterinary preparations, £1 million.

Glucose dumping

Assurance has been given in Federal Parliament that the Government will stop any dumping of American glucose

on the Australian market if complaints are brought to its notice.

New company

Australian Fluorine Chemicals Pty. Ltd. has been formed by Consolidated Zinc Pty. Ltd. and Monsanto Chemicals (Australia) Ltd., with authorised capital of £2 million. The company will initially manufacture fluorocarbons, and later other products of mutual interest. Production is expected to begin during 1961.

Americans set pace in drug industry

The turnover of the Drug Houses of Australia group rose by 4½%, but due to increased competition there was a decline in gross profits. This competition is shown by the number of expansion plans recently announced by various manufacturers, mainly American.

At Ermington, N.S.W., Pfizer Corp. is building a £A260,000 factory to make antibiotics. In the same district Sterling Pharmaceuticals Pty. Ltd. has a new £A1 million plant for a wide range of medicines.

The Upjohn Co. (Australia) Pty. Ltd., which is associated with companies in Britain and the United States, has a £A1 million project to make pharmaceuticals at Rydalmere, N.S.W. and Warner-Lambert Pty. Ltd. is building a £A500,000 pharmaceuticals plant at Villawood.

SOUTH AFRICA

Phosphate production

In the year ended March 31, 1960, African Metals Corpn. Ltd. produced at the Bellville works 105,490 tons of Langfos phosphate fertiliser compared with 111,212 tons the previous year. Although the corporation owns extensive phosphate deposits in the Langebaan area, the higher grade material is being steadily depleted and research is being devoted to upgrading low-grade rock. The economics and design of a suitable plant are being studied. Meanwhile, prospecting for reserves in the area continues.

Shark repellant

As reported in the MANUFACTURING CHEMIST, February 1960, page 88, germs from the teeth of living sharks, which cause such deadly sepsis following their bites, have been cultured and examined. Three doctors at the Marine Biological Research Station at Durban discovered a virulent hæmolytic (blood destroying) staphylococcus which appears to be the causal organism.

It has now been suggested that bathers be given a " pill " made from a certain chemical mixed in dough to wear around their waists. In salt water the pill would set up a chemical reaction which would repel an attacking shark. A shark repellent in the form of crystals has also been considered. The crystals contain water-soluble dye which turns water black. Together with acetate elements, the crystals blind a shark and repel it.

Rexall expansion

The Rexall Drug Co. S.A. (Pty.) Ltd., Port Elizabeth, have started on their £45,000 expansion scheme, designed to increase the factory floor space by about a third and to raise output at least 50%. The factory will be equipped with several new types of equipment to improve quantity and quality production, including a large dehumidification plant in the tablet compression department. In addition a £1,000 spectrophotometer is being installed.

Oral polio vaccine

Oral polio vaccine in liquid form is being produced by the Poliomyelitis Research Foundation in Johannesburg, and will be issued to local authorities at subsidised rates.

This new live polio vaccine will be flavoured either strawberry or raspberry. Peppermint and chocolate were found to be impracticable. In producing ten million doses of the new vaccine for consumption in South Africa, the Foundation studied the art of sweet making and discovered that strawberry and raspberry were the most popular flavours with children. It was found that peppermint did not appeal to many children. The scientists also tried producing vaccine with a chocolate flavour. But the melting-point of chocolate is too high and the viruses died.

New export market

A firm making industrial chemicals and explosives is exporting its products to Ceylon, Thailand and North Borneo to replace an export market lost through Malaya refusing to buy South African goods. The exports include quantities of sodium arsenite (a weed-killer used in rubber and cocoa plantations). The firm also hopes to export 10,000 tons of urea to the Coffee Institute of Brazil.

HUNGARY

Fungicide for skin

A new product for preventing fungus diseases of the skin has been marketed under the name of Mikofen. Another product, Fungifen, which, it is claimed will heal skin attacked by fungus diseases, will be available soon.

THE TECHNICAL PRESS IN DECEMBER

Milford Haven Refinery Goes on Stream

The main feature in **Petroleum** is a report on the new Esso refinery and marine terminal at Milford Haven. This covers the design and operation of the refinery as well as a detailed description of the equipment installed. " Combustion Research " describes work done in the Shell and B.P. fuel laboratories. In-line blending and analysis is described in " Quality Control "—a report on the Elliott Bros. symposium.

Chemical and Process Engineering has a special feature on fluid control this month. It includes two articles, " Principles of Fluid Control " and " Flow Measurement Errors." The series on materials of construction for chemical plant continues with a description of the use of timber. In the same issue is a report on the Congress of Industrial Chemistry in Barcelona, and the first part of an article " Transient Performances of Heat Exchangers."

A guide to synthetic resins introduced in the last year is included in **Paint Manufacture,** as well as recent advances made in the use of epoxide resins in surface coatings.

Fibres and Plastics has a special review dealing with non-woven fabrics, and articles on this topic include: " Structural Aspects of Bonding," " Some Market Aspects of Non-Woven Textiles," " Progress in Binders Controls the Future of Non-Woven Textiles," and " Non-Woven Fabrics Review." Also in this issue are " Processing High Density Polythene," " Polythene Coated Papers," and " High Temperature Resistance and Thermal Degradation of Polymers."

Corrosion Technology reviews the recent Corrosion and Metal Finishing Exhibition. " Influence of Water Movement on Corrosion—Non Ferrous Materials " and " Tests on Neoprene and Hypalon Based Coatings " are two important articles, as well as " PVC Pipes in the Chemical and Gas Industries."

World Crops contains a preview of the Smithfield Show, and articles on aerial spraying of rubber, the importance of shade for growing tea and coffee, and world population feeding problems.

A simplified nuclear reactor simulator is described in **Automation Progress.** Other articles include " Circuit Blocks and Initial Design," " Self Organising Systems " and " Synchros."

Dairy Engineering reports on " Psychrophilic Bacteria in Pasteurised Milk," " Review of the Dairy Show " and " Manufacture of Instant Milk."

The National College of Food Technology at Weybridge is described in **Food Manufacture.** Articles also include " How Food Yeast is Made in Formosa," " Milk Processing Machinery," and a factory visit report on the C.W.S. Preserve works at Reading.

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Miscellaneous

Process for the manufacture of hydrophilic high molecular weight substances from dextran substances. *Pharmacia A.B.* 854,715.

Foamed materials containing urethane groups. *Farbenfabriken Bayer A.G.* 853,915.

Calcining of gypsum. *O. E. A. Aspegren.* 853,812.

Manufacture of aminoimidazolidone. *Norwich Pharmacal Co.* 853,498.

Process for the manufacture of hydroxamic acids. *Imperial Chemicals Industries Ltd.* 852,176.

Hydroxamic acids and derivatives thereof. *Imperial Chemical Industries Ltd.* 852,100.

Phosphoric and thiophosphoric acid ester amides and the production thereof. *Asta-Werke Aktiengesellschaft Chemische Fabrik.* 853,044.

Detergents

Synthetic liquid detergents. *Diamond Alkali Co.* 852,941.

Fungicides

Fungicidal compositions. *Imperial Chemical Industries Ltd.* 852,634.

Fungicidal compositions containing isocycloheximide. *O. Upjohn Co.* 853,636.

Insecticides

3-Isopropylphenyl N-methylcarbamate and insecticidal compositions containing same. *Union Carbide Corporation.* 852,920.

Dyestuffs

Anthraquinone vat dyestuffs and their use. *J. R. Geigy A.G.* 853,969.

Water-soluble reactive dyestuffs. *Imperial Chemical Industries Ltd.* 854,962.

Azo-dyestuffs derived from 1 : 3-dihydroxy phenyl ketones. *Farbwerke Hoechst A.G.* 854,404.

Trisazo dyestuffs and their preparation. *Yorkshire Dyeware and Chemical Co. Ltd., and D. C. Wilson.* 854,957.

New patents are from the *Journal of Patents*, and new trade marks are from the *Trade Marks Journal*. In each case permission to publish has been given by the controller of Her Majesty's Stationery Office. Each of the publications mentioned is obtainable from the Patent Office, 26 Southampton Buildings, London, W.C.2.

NEW TRADE MARKS

APPLICATIONS

Cosmetics and toilet preparations

AUTOMAGIC.—B792,071. AUTOMAGIC MAKE-UP.—B792,075. MAQUILLAGE AUTOMAGIQUE.—B792,079. *Antoine François Regis Peyron.*

FIELDSMAN.—804,499. *J. C. and J. Field Ltd.*

OUTDOOR GIRL YOUNG SET.—802,828. *Crystal Products Co. Ltd.*

FOREVER SPRING.—800,271. *Avon Cosmetics Ltd.*

ZODIAC.—802,296. *Brentford Soap Co. Ltd.*

LOTTO.—803,692. *Thomas Hedley and Co. Ltd.*

EVO-TINN.—805,734. *Evode Ltd.*

TALONAL.—797,485. *Talanol Ltd.*

SPAN.—797,681. *County Laboratories Ltd.*

TYCOON.—805,251. *H. and T. Kirby and Co. Ltd.*

ARVAL. — 800,406. *Laboratoires Biologiques Arval S.A. Sion.*

Pharmaceuticals

ZESTATABS.—B789,703. *James Lowry Stirling.*

ZIMEMA.—793,276. *Laboratorio Chimico Farmaceutico V. Baldacci.*

CEPORIN.—799,470. *Glaxo Laboratories Ltd.*

SALIDREX.—802,028. *Ciba Ltd.*

MONOSCLERIN.—802,383. *Uni-Chemie A.G.*

DESERT DRI.—802,719. *Shulton Inc.*

FLUMINAX.—803,886. *Bayer Products Ltd.*

MONEEDA.—804,234. *Moore Medicinal Products Ltd.*

ISTUMOL.—804,970. *I.C.I. Ltd.*

CO-TROXIN.—805,179. *Glaxo Laboratories Ltd.*

NIAMID.—788,105. *Chas. Pfizer and Co. Inc.*

LONGOCTIVE.—798,105. *Roche Products Ltd.*

POSTUSIN.—798,647. *Winthrop Products Ltd.*

ANAPROTIN. — 799,006. *Uni-Chemie A.G.*

MOORES AN-JEL.—*Moore Medicinal Products Ltd.*

BRIETAL.—804,401. *Eli Lilly and Co.*

CORTIMENT.—804,831. *Ferring A.B.*

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd. company registration agents, Chancery Lane, London, W.C.2.

Leach Chemists Ltd. 21.9.60. 12 Sheep Street, Northampton. To take over bus. of a druggist cd. on as T. H. Leach at Northampton. £2,000. Dirs.: S. E. and Dorothy M. Eyre and M. D. Bailey.

Sheron Chemists Ltd. 26.9.60. 46 Upton Lane, Forest Gate, London, E.7. Chemists. £1,000. Dirs.: R. Shear and W. Onnie.

Shell Chemical Co. of Eastern Africa Ltd. 27.9.60. £20,000. Dirs.: to be apptd. Subs.: John G. Theaker and R. Armitage, St. Helen's Place, Gt. St. Helens, London, E.C. 3.

H. Crawshaw (Chemists) Ltd. 28.9.60. 24 Bolton Road, West, Ramsbottom, via Bury. To take over bus. of chemists, druggists, etc., cd. on as H. Crawshaw at Ramsbottom. £1,500. Dirs.: H. and Mrs. C. H. Crawshaw.

Derek Wallace (Chemists) Ltd. 9.9.60. 207 Darwen Road, Bromley Cross, nr. Bolton. £2,000. Dirs.: Derek and Hilda Wallace.

J. H. Wilmshurst Ltd. 12.9.60. 58 Crabtree Lane, Lancing. Chemists, etc. £2,000. Dirs.: James H. and Mrs. M. M. Wilmshurst.

Southbourne Pharmacy Ltd. 12.9.60. 7 St. Catherines Rd., Southbourne, Bournemouth. £1,000. Dirs.: Peter Barnes and Heather Denning.

J. H. Harper Ltd. 14.9.60. 23 Green Lane, Ashton-on-Mersey, Sale. To take over bus. of pharmaceutical chemist cd. on at Sale by J. H. Harper, etc. £100. Dirs.: John H. and Muriel I. Harper.

Blacklock (Chemists) Ltd. 15.9.60. To take over bus. of chemists and druggists cd. on at 40 Commercial Rd., Bournemouth, as "Blacklock and Co." £100. Dirs.: to be apptd. Subs.: A. F. A. and Mrs. D. Taylor, Tudor Links, Benellen Av., Westbourne, Bournemouth.

H. G. Bowles Ltd. 15.9.60. Selsey Cottage, Milford Rd., Elstead, nr. Godalming. Chemists, etc. £3,000. Dirs.: Harry G. and Mrs. E. E. Bowles.

B.N.M. Laboratories Ltd. 11.10.60. Mnfrs. of and dlrs. in pharmaceutical and other preparations. £100. Dirs. not named. Subs.: C. G. Walton and P. E. Creed, 35 King Street, Luton.

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MANUFACTURING CHEMIST
and Manufacturing Perfumer

Index to Volume XXXI, 1960

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Article headings are in quotation marks.

Key to abbreviations: Abstracts (abs.), Reference in Progress Report (p.r.), and Letters (l.).

The following group headings are used:

Aerosols	**Instruments and apparatus**
Analgesics	**Packaging**
Anthelmintics	**Perfumery**
Antibiotics	**Pesticides**
Book Reviews	**Pharmaceuticals**
Cancer	**Plant and equipment**
Company finance	**Polio vaccine**
Cosmetics	**Research**
Detergents	**Safety**
Drugs	**Soaps**
Essential oils	**Vaccines**
Fertilisers	**Veterinary medicines**
Fire prevention	**Viruses**
Fungicides	**Vitamins**
Hormones	**Weedkillers**
Hypertension	
Insecticides	

AUTHOR INDEX

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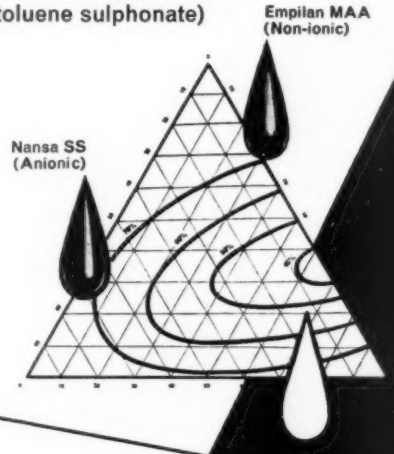

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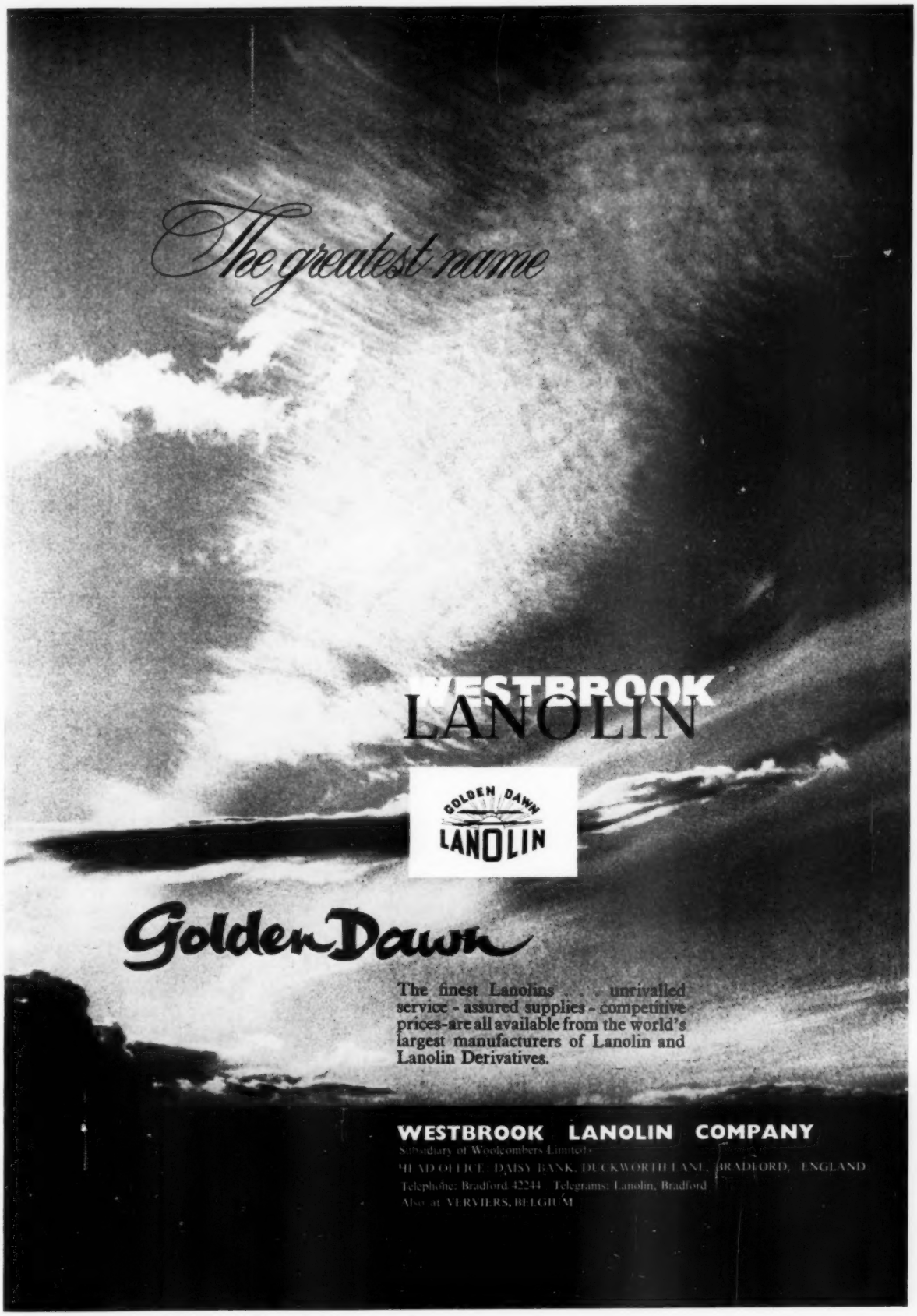
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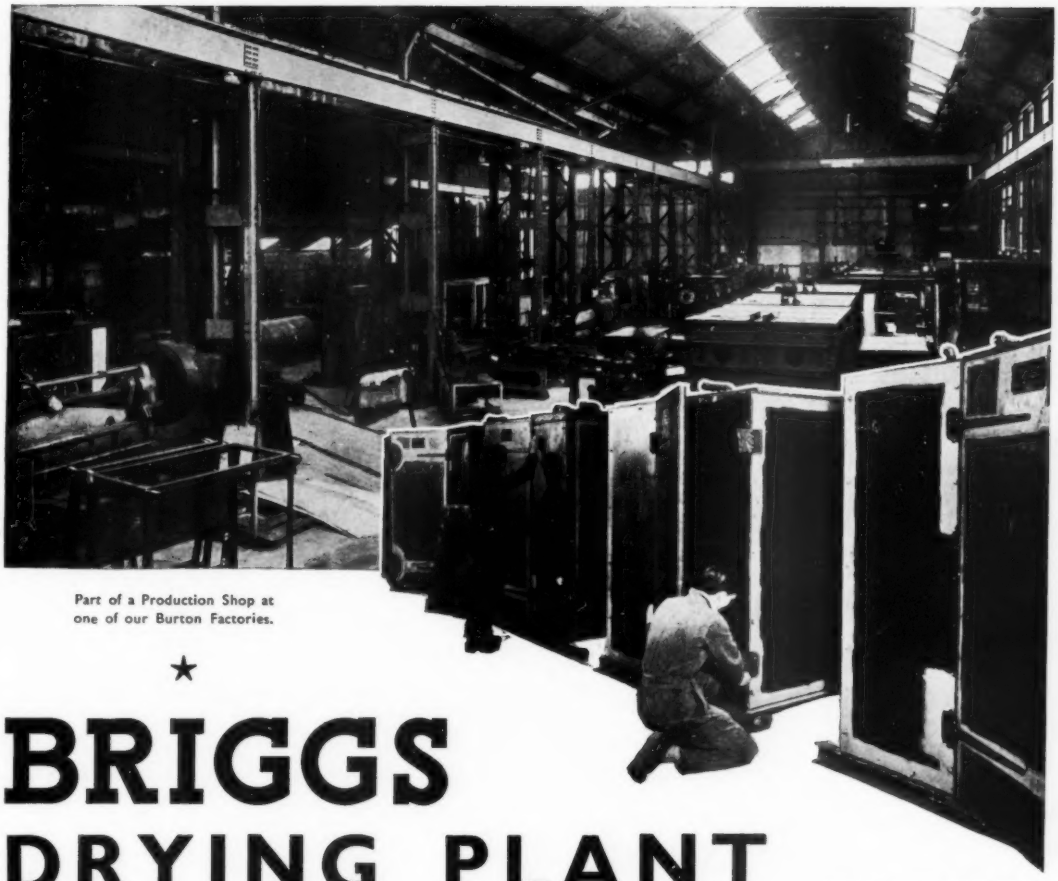

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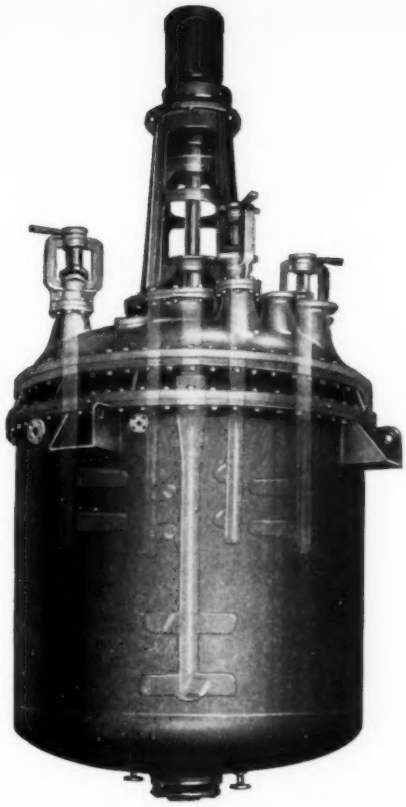

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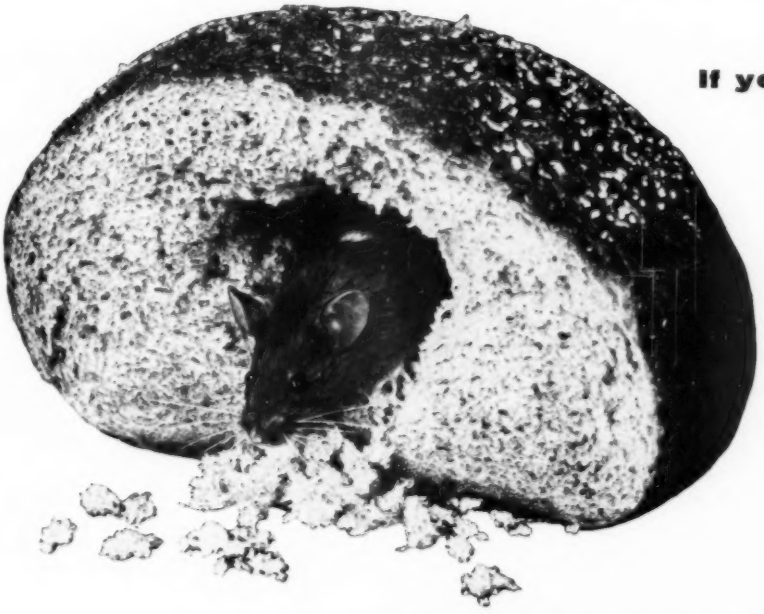

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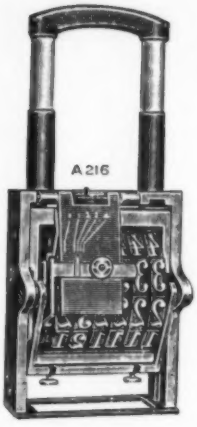

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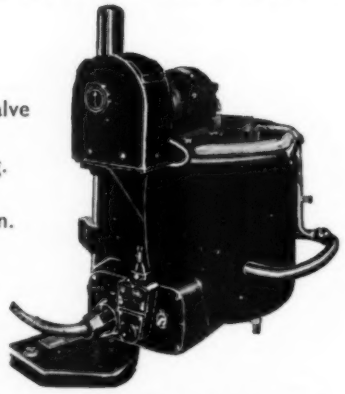

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I.S.I.S. is an organisation backed by a large industrial group of consultants with contacts in all the industries based on technology. As an addition to their present resources they have established this Appointments Register. Below will be found some of those technologists who are looking for further opportunities. Employers and Personnel Officers are invited to complete the form below, detach and send to the above address. In this particular instance the use of a form, with its attendant simplification of office systems, ensures speedier results for the employer.

Ref. A.837. British. Female. Single. Age 38. 1st and 2nd M.B., and Inter B.A. (French, Greek, History and Logic). Experience includes 5 years Teaching Maths and Science. 3 months Translator, banking. 4 months Editor, scientific translation. Fluent French and German. Seeks post as **SCIENTIFIC LIBRARIAN/SCIENTIFIC JOURNALIST/TECHNICAL TRANSLATOR/RESEARCH OR INFORMATION ASSISTANT.** London. £700 p.a.

Ref. A.838. British. Male. Married. Age 41. M.Sc. Metallurgy, professional qualifications in Engineering, Metallurgy and Management. Author of wide range of technical papers. Has held technical staff appointments in the services and Senior Industrial Appointments concerned with chemical and methods engineering. At present Chief Chemist/Metallurgist, manufacturing engineers. Seeks appointment as **TECHNICAL DIRECTOR/CHIEF CHEMIST/METALLURGIST.** England. £3,000 p.a.

Ref. A.839. British. Male. Married. Age 33. H.N.C. (Mech.). 5½ years Draughtsman, contract drawing office. 8 months Draughtsman, steam equipment. 5½ years Design Draughtsman, steelworks cranes and machinery. 1 year Design Draughtsman, ore handling conveyors. 1 year Offices Stress Engineer and 6 months Senior Design Draughtsman, aircraft undercarriages. At present Senior Design Engineer responsible to Works Director, general experimental and prototype engineering (special purpose machinery, aircraft servicing equipment, test rigs, guided weapon launchers, aircraft ducting. Seeks post as **DESIGN OR MECHANICAL ENGINEER (IN LEADING OR EXECUTIVE CAPACITY OR AS CHIEF DRAUGHTSMAN).** London, North Kent or East Surrey. £1,800 p.a.

Ref. A.840. British. Male. Married. Age 29. Joined R.N. as Artificer Apprentice and is now Engine Room Artificer 1st Class (Fitter and Turner to trade), submarines. Experience, marine engineering. Leaving R.N. February 1961 and seeks **DIESEL OR HYDRAULIC ENGINEERING POST.** U.K.—not London—or abroad. £1,000 p.a.

Ref. A.841. British. Male. Single. Age 29. M.A. (Cantab) degree in Engineering. 1 year Trainee Apprentice, mechanical engineer. At present Technical Sales Assistant, mechanical and electrical engineers. Fair knowledge French and German. Seeks post as **TECHNICAL SALES ENGINEER.** London. £1,250 p.a.

Ref. A.842. British. Male. Married. Age 46. Inter B.Sc. (Engg.). 3 years Draughtsman fuel injection (diesel and automobile equipment). 2 years Designer, precision instruments. 2 years Designer, photographic apparatus. 7 months Designer, gyroscopic apparatus. 3 years Draughtsman, electrical engineering. 1 year Designer, electrical engineering. At present Mechanical Designer, radar and electronics development and manufacturer. Seeks post as **CHIEF DRAUGHTSMAN/DESIGNER/MECHANICAL ENGINEER.** West of England—preferably Cirencester, Oxford, Swindon districts—or S.W. Midlands, or would consider **TECHNICAL REPRESENTATION** based on these areas. £1,500 p.a.

Ref. A.843. British. Male. Married. Age 27. O.N.C. (Mech. Eng.). 3 months Fitter's Course and 9 months Draughtsmanship Course at Government training centre. 1 year Trainee Quantity Surveyor, civil engineers. 3 years Design Draughtsman, diesel engine manufacturers. At present Design Draughtsman, domestic appliances manufacturers. Seeks post as Design Draughtsman. U.K.—not London—or Canada or S. America. £900 p.a.

Ref. A.844. British. Male. Married. Age 33. Full apprenticeship as Boilermaker-Welder and technical education to O.N.C. standard in marine engineering, machine drawing, workshop apprentice mechanical and electric. Now preparing for M.O.T. 2nd Class (Motor) Cert. of Competency. 17 years R.N. as Engine Room Artificer, i/c running and maintenance air conditioning and refrigeration plant, air compressors, hydraulic pumps, large diesel engines, boilers and turbo machinery. Seeks post as **MAINTENANCE OR PLANT FOREMAN.** U.K.—preferably Bristol area. £1,100 p.a.

Ref. A.845. British. Male. Married. Age 40. M.O.T. 2nd Class (Steam), A.Inst.Mar.E. 4 years Apprentice Engineer, mechanical engineers. 12 years Engineer in Merchant Navy up to and including Chief Engineer. 3½ years Assistant Engineer, mechanical and marine engineers. 2 years Resident Engineer, engineers, tug and barge owners and refrigeration stores. At present Power House Engineer, woodworking all classes on large scale. Considerable experience running and maintenance steam turbines and water tube boilers, diesel engines, pumping plant, refrigeration and air-conditioning plant. Seeks post as **MAINTENANCE OR MECHANICAL ENGINEER.** U.K. or abroad.

Ref. A.846. British. Male. Single. Age 23. H.N.C. Applied Physics. At present employed in Research Laboratory, defence research. Seeks post as **DEVELOPMENT ENGINEER / TECHNICAL ASSISTANT**—preferably electronics. U.K. or abroad. £750 p.a.

Ref. A.847. British. Male. Married. Age 44. A.M.I.E.E., A.M.I.Loco.E. 3½ years Trainee, rectification equipment with manufacturing electrical engineers. 6 years Test, Drawing Office and Design, manufacturer motors, geared units. 4 years Electrical Officer, R.N. 8 years Design Engineer, manufacturing electrical engineers (electrical traction). 5 years Senior Design and Development Engineer i/c Group, manufacturing electrical engineers. At present Senior Design and Development Engineer, electrical and mechanical engineers. Considerable experience visit to customers U.K. and abroad for technical discussion and to give operational and maintenance advice. Seeks post as **TECHNICAL MANAGER OR CHIEF ENGINEER, OR SIMILAR.** Birmingham or London. £2,500 p.a.

Ref. A.848. British. Male. Married. Age 39. M.O.T. Cert. of Service as 1st Class Engineer (Steam and Diesel), M.Inst.Mar.E. 23 years R.N., including 4½ years full apprenticeship as Mechanical Engineer, 8 years Artificer, 11 years Engineer Officer. At present Engineer Lieutenant and leaving R.N. November 1960. Considerable diesel and steam experience, and refitting and plant maintenance and planned maintenance experience. Seeks post as **ASSISTANT WORKS ENGINEER OR MAINTENANCE ENGINEER OR SHORE-BASED MARINE ENGINEER.** London or South. Coast of England. £1,500 p.a.

Ref. A.849. French. Male. Married. Age 36. **RESIDENT U.K.** H.N.C. (Mech.), B.E.I. (French award). Bilingual English/French. 3 years Design Draughtsman, automotive engineers (car manufacturer). 1 year Engineering Draughtsman, hydraulic engineers, contract drawing office. 3 years Engineering Draughtsman, welding and flame cutting equipment manufacturers. At present Plant Design Engineer, light structural engineers. Considerable experience electro mechanical devices and electrical circuits, hydraulic and pneumatic application—handling of complete project from cost justification to acceptance tests—team leading and drawing office management. Seeks post as **CHIEF ENGINEER (DESIGN) OR ENGINEER (PLANT MAINTENANCE).** Hertfordshire, N.W. London or France. £1,500/£2,000 p.a.

Ref. A.850. British. Male. Married. Age 34. 3½ years Apprentice Fitter and Turner, sugar refiners. 2 years Airframe Fitter, R.A.F. 1 year Maintenance Fitter, sugar refiners. 5½ years Maintenance Fitter, ship repairers. 2½ years Maintenance Fitter, coal by-products refiners. 3½ years Draughtsman, electrical and mechanical engineers. At present Draughtsman, hospital equipment. Seeks post as **DRAUGHTSMAN.** East Anglia—preferably Norwich area. £900 p.a.

(continued overleaf)

To: I.S.I.S. Appointments Register, 9, Eden Street, London, N.W.1. Please ask the following applicants to communicate with the undersigned:

Ref.:.....	**Ref.:**.....	**Ref.:**.....	**Ref.:**.....
Ref.:.....	**Ref.:**.....	**Ref.:**.....	**Ref.:**.....
Ref.:.....	**Ref.:**.....	**Ref.:**.....	**Ref.:**.....

Please use Block capitals

Name: .....

Position: .....

Company: .....

Business or Profession: .....

Address: .....

All introductions are made on the understanding that should an engagement result the employer agrees to I.S.I.S. Appointments Register's terms, which are as follows:

For each person engaged the equivalent of two weeks salary payable by the employer within fourteen days of the date of engagement.

Signature..... Date.....

I.S.I.S. APPOINTMENTS REGISTER *(Continued from previous page)*

Ref. A.851. British. Male. Married. Age 40. C. & G., A.M.I.E.E. 8 months Technical Officer, 6 years Assistant Engineer, 3 years Senior Telecommunications Engineer, 10 months Acting Principal Telecommunications Engineer, public telecommunications services. At present Senior Telecommunications Engineer, public telephone, telegraph service. Seeks post U.K., Europe or South America.

Ref. A.852. British. Male. Single. Age 29. O.N.C. Mech. Eng. 10 years Engineering Assistant, chemical industries. At present Inspection and Liaison Engineer, nuclear engineering. Seeks post as **PROGRESS/LIAISON ENGINEER.** Liverpool area. £1,100 p.a.

Ref. A.853. British. Male. Married. Age 35. Ex. Grad.R.Ae.S., F.R.S.A. 2 years Trainee in design and works, aircraft hydraulic engineers. 14 years Design Draughtsman, airframe and ground equipment. 3 months Project Designer, light engineering. 4 years i/c of Production Design and Works Liaison, airframe and equipment manufacturers. At present in charge of Productions Design Office with aircraft manufacturers and designers. Considerable experience on mass production and works management. Seeks post as **DESIGN OFFICE MANAGER OR IN TECHNICAL LIAISON.** U.K.—not London. £1,500 p.a.

Ref. A.854. British. Male. Married. Age 26. H.N.C. (Elec.), Grad.I.E.E. 4 years Student Apprentice and 1 year Assistant Design Engineer, electrical engineers. 2 years National Service as radio instructor. 1½ years Design Engineer, rectifier equipment. Seeks post as **ELECTRICAL ENGINEER.** Jamaica or S. Africa. £950 p.a. approximately.

Ref. A.855. British. Male. Married. Age 26. O.N.C. Mech. Eng. 4 years Apprenticeship—toolmaker and jig and tool draughtsman. 3¾ years Die and Model Draughtsman, precision castings. At present Design Draughtsman, electro servo mechanisms and aircraft fuel systems. Considerable experience in precision foundries on investment casting work (small aircraft parts, turbine blades, etc.) and also interested in chemical engineering/plastics. Seeks post as **DESIGN DRAUGHTSMAN.** U.K., Canada, U.S.A. or Australia. £1,000 p.a.

Ref. A.856. British. Single. Age 19. G.C.E Maths and Physics. Experience includes 9 months Junior Salesman, truck and ladder manufacturers. At present Accounts Clerk, purveyors of petroleum spirit. Seeks post as **LABORATORY ASSISTANT.** London. £8 per week approximately.

Ref. A.857. Indian. Male. Single. Age 30. **RESIDENT U.K.** B.Sc., H.N.C. Mech. Engg. 3¾ years Junior Planning Engineer and 1 year Senior Planning Engineer, Locomotive manufacturers. 2 years Post Graduate Trainee, U.K. locomotive manufacturers. 5 years Mechanical Engineering Apprenticeship. At present Design Draughtsman, special purpose hydraulic equipment. Wide experience pre-production, processing, rate fixing, etc. in production engineering. Seeks post as **PLANNING ENGINEER.** England. £900 p.a.

Ref. A.858. British. Male. Married. Age 27. O.N.C. Mech. Studying for A.M.I.E.D. 5 years Apprentice (engineering), precision instruments. 1 year Engineer, precision instruments. 6 months Experimental Technician, aircraft manufacturer. 6 months Experimental Technician, press tools. 1½ years Experimental Technician, atomic energy research. At present Cryogenics Technician, nuclear research, in Switzerland. Seeks **EXPERIMENTAL OR DEVELOPMENT POST.** England or abroad, except Africa. £1,000 p.a. minimum.

Ref. A.859. British. Male. Married. Age 25. O.N.C.—2 years—Elec. Engg. Studying for H.N.C. Elec. Engg. 6 months Trainee Draughtsman, heating and lighting engineers. 4½ years Technical Clerk, civil service. 11 months Draughtsman, signals. At present Draughtsman, electrical and signal engineers. Seeks post as **DRAUGHTSMEN.** U.K.—preferably London. £800 p.a.

Ref. A.860. British. Female. Married. Age 24. G.C.E. Chemistry and Science. 3 years Laboratory Assistant, medical school. At present Research Assistant, biochemical research. Wide experience analytical methods chromatography, colouremetric, Kjedahl Warburg assays. Seeks post as **TECHNICIAN**—preferably biochemical. Romford/Hornchurch, East London or City areas. £500/£600 p.a. approximately.

Ref. A.861. British. Male. Married. Age 28. B.Sc. (Chem.). Since graduating has spent 1 year on research and 3 years on production, with short periods i/c small factory. At present Process Superintendent, fertiliser manufacturers. Seeks **EXECUTIVE/MANAGERIAL POST.** U.K.—not London. £1,125 p.a.

Ref. A.862. British. Male. Married. Age 26. H.N.C. Mech. Apprenticeship as Marine Engine Fitter. At present Design Draughtsman, marine engineers. Experienced reciprocating air compressors and refrigeration. Seeks post as **DESIGN DRAUGHTSMAN.** U.K.—not London. £18 per week.

Ref. A.863. British. Male. Single. Age 25. Mech. Sciences Tripos Pt. I. (2nd class). Vacation employment includes 3 months Student Engineer, consulting engineers. 3 months Student Trainee, papermaker. 3 months Survey Crewman, consulting engineers. At present Graduate Apprentice, heavy engineering. Seeks **PRODUCTION ENGINEERING POST.** London or abroad. £900 p.a.

Ref. A.864. British. Male. Married. Age 52. H.N.C. Mech. Eng., Diploma in Archaeology, A.M.I.Mech. 5 years Student Apprentice, city corporation. 9 years Designer, engineers and instrument makers. 7 years Chief Designer, optical apparatus. 5 years Chief Designer, engineers. 6 years Chief Designer and Manager of Experimental Workshop, optical apparatus. At present Works Manager, engineer and instrument makers. Can undertake styling of products in addition to design and productions. Accustomed complete responsibility of machine design and production. Seeks post as **CHIEF ENGINEER/WORKS MANAGER OR DESIGNER.** London or Home Counties. £1,800 p.a.

Ref. A.865. British. Male. Single. Age 23. H.N.C. Mech. Eng., G.I.Mech.E., studying for B.I.M. Diploma. 2 years Graduate Apprenticeship, aircraft ancillaries. At present Production Assistant, aircraft ancillaries. Seeks post as **PRODUCTION ENGINEER OR POSITION LEADING TO WORK MANAGEMENT.** N.E. Middlesex. £800/£850 p.a.

Ref. A.866. British. Male. Married. Age 35. H.N.C. and Endorsements. 7 years Apprenticeship, aircraft and furniture manufacturers. 4 years Design Draughtsman, photocopying machines. 4 years Design Draughtsman, duplicating machines. At present Development Engineer, manufacturers of oxy-acetylene cutting and welding equipment and machines. Seeks **DEVELOPMENT/DESIGN OR TECHNICAL REPRESENTATION APPOINTMENT.** N. and N.E. London, Ware, Hertford or Harlow areas. £1,100 p.a. approximately.

Ref. A.867. British. Male. Married. Age 29. B.Sc. (Eng.), D.I.C., A.M.I.C.E., A.M.Inst.H.E. 4 months Assistant Resident Engineer, county council. 7¾ years Assistant Civil Engineer, government department. 4 months Site Engineer, civil engineering contractors. At present Design Engineer, civil engineering contractor. Seeks **CIVIL ENGINEERING POST,** e.g. with civil engineering contractor as Project Engineer/Assistant to Contract Manager, or with civil engineering consultant or consulting engineer directly responsible to Partner, or with industrial firm responsible for buildings and services. U.K.—preferably London. £1,300 p.a. approximately.

Ref. A.868. British. Male. Married. Age 40. Ground Engg. Certs., B.Sc. (Eng.,) F.S.A. (Scot.) 3 years Planning and Production Engineer, aeronautical engineers. 1 year Chief Tool Draughtsman, pressings, moulds, rubber and plastic and metal components. 1 year Production Engineer, electro-mechanical assemblies. 7 years Senior Tool Designer/Planning and Production Engineer, heating and ventilating engineers. 2 years Assistant Production Manager, metal pressings and fabrications. At present Tool Design Consultant/Assistant Works Manager, precision tools. Seeks post as **WORKS OR GENERAL MANAGER OR PRODUCTION MANAGER.** London or Scotland preferred. £1,750/£2,000 p.a.

Ref. A.869. British. Male. Single. Age 32. O.N.C. and H.N.C. Mech., and O.N.C. Elect. and endorsements, G.Inst.Mech.E. 2 years Trainee, builders' merchants. 4 years Engineer, car manufacturers. 2 years Personal Assistant to the Manager, consultant mechanical engineers. At present Technical Mechanical Liaison Engineer, guided missile manufacturers. Seeks **ENGINEERING MANAGEMENT OR JUNIOR TRAINEE POST.** London or U.S.A. £1,100 p.a.

Ref. A.870. British. Male. Married. Age 35. Diploma in Public Administration, London Univ., B.Sc. (Economics). Experience includes 4¾ years Assistant (Clerical), electricity distribution. 1½ years Costing Clerk, electricity distribution. 6½ years electricity generation and supply, responsible for personnel and establishments administration, printing, stationery, form control, office machinery and equipment. Seeks **MANAGERIAL (PERSONNEL OR ADMINISTRATION) POST.** U.K.—not London. £1,400 p.a.

Ref. A.871. British. Male. Married. Age 26. 4 years Airframe Fitter. 1½ years Tool Room work, motor vehicle manufacturers. At present Storekeeper/Buyer, auto research engineer, complete charge of large stores and majority of buying. Seeks post as **BUYER.** U.K. £15 per week.

Ref. A.872. British. Single. Age 23. O.N.C. and H.N.C. and Endorsements. 3 years general machine shop training. 2 years Planning experience and at present Jig and Tool Draughtsman, precision machine tool engineers. Seeks post with **CONSULTANT PRODUCTION ENGINEERS.** U.K.

Ref. A.873. British. Male. Single. Age 28. O.N.C. 1½ years Design Draughtsman and Section Leader, hydraulic pumps and test rigs and special machines. 1 year Design Draughtsman, contract design office. At present Contract Draughtsman (on loan), motor car manufacturers, design and supervision of installation on site of specialised melting and hot metal handling equipment and general mechanical handling of materials. Seeks post **DESIGN DRAUGHTSMAN.** London or Kent. £1,200 p.a.

Ref. A.874. British. Male. Married. Age 30. B.Sc. (Physics and Maths with some Chem.). 3 years Trials Engineer (telemetry), guided weapons. At present Systems Engineer (nucleonics), electronic instrumentation. Seeks post as **ENGINEER (ELECTRONICS, ETC.).** Gloucester, Wilts., Somerset, Dorset, Oxon, West Berks., West Hampshire areas. £950/£1,050 p.a.

Ref. A.875. British. Male. Married. Age 32. B.A. (Maths) (Cantab), M.A., B.Sc. Special (Hons. Maths). 1½ years Administrative work, meteorology and aviation. 3 years Group Leader of team of scientists, guided missiles. 5 years Instr. Lt. (R.N.) (Meteorologist). Fluent Spanish and French, some Italian and German. Seeks post as **MATHEMATICIAN/METEOROLOGIST OR REPRESENTATIVE.** Preferably tropics or sub-tropics. £1,100 p.a. minimum.

Ref. A.876. British. Male. Single. Age 23. G.C.E. "A" Level Advanced Physics, Chem., Pure Maths. Higher Physics to B.Sc. Gen. standard. Chem. Diploma to A.R.I.C. II Standard. 3 months Assistant in Research Laboratory, resin manufacturers. 5 years Technical Staff Trainee, electricity board. At present engaged in Control Operation work—refinery, oil operation department, oil production and refining. Seeks **SUPERVISORY POST LEADING TO MANAGEMENT.** S. America, Central America or Carribbean. £1,200 p.a.

Ref. A.877. British. Male. Single. Age 22. H.N.C. Mech. and studying for G.I.Mech.E. 5 years Student Apprentice, aircraft. At present Development Engineer, filtration and silencing engineering. Seeks post as **MECHANICAL DESIGN ENGINEER.** U.K. £650 p.a.

Ref. A.878. British. Male. Married. Age 37. O.N.C. (Chem.), Assoc.M.C.T. 3 years Junior Chemist, coal tar and oil distillers. 8 years Technologist i/c powder metallurgy processes, powder metallurgy and non-ferrous wire manufacturers. 9 years experience of plant used in heavy chemical industry, contract engineering, plant commissioning and provision of technical service to clients. At present Sales and Contracts Engineer, engineering organisations. Seeks appointment as **PLANT OR PROCESS/SUPERINTENDENT OR CONTRACTS ENGINEER.** U.K. £1,100 p.a.

Ref. A.879. British. Male. Single. Age 22. H.N.C. Mech. Apprenticeship in heavy mechanical engineering. At present Junior Draughtsman, heavy mechanical engineering. Seeks post as **ASSISTANT ENGINEER (MECHANICAL).** London. £15/£16 per week.

Ref. A.880. British. Male. Married. Age 30. H.N.C. Elect. Engg. 1 year Learner Fitter, general metal work. 3 years Assistant Electrician, repair, installation of electrical plant. 5 years Technician, light electro-mechanical apparatus development and manufacturers. 2 years Design Draughtsman, aircraft manufacturer and guided missile development. At present Senior Design Draughtsman, precision instruments (electro-mechanical). Seeks post as **DESIGN OR PROJECT ENGINEER.** Surrey, Berks., Bucks. or Hampshire. £1,250 p.a.

Ref. A.881. British. Male. Married. Age 26 A.M.R.I.N.A., H.N.C. Naval Architecture with Endorsements in Shipyard Practice and Organisation, Advanced Theory and Design. 5 years Apprentice and 3 years Ships' Draughtsman, shipbuilders and engineers. Seeks post with **GOOD PROSPECTS OF LEAVING DRAWING BOARD AND DEALING WITH PRACTICAL ASPECTS OF SHIPBUILDING.** U.K. £18 per week.

Ref. A.883. British. Male. Married. Age 28. O.N.C. and H.N.C. Mech. Eng. with all Endorsements for A.M.I.Mech.E., Student of Inst. of Mech. Eng. and Grad. applied for. 5½ years Apprentice, manufacturers of lighting fittings, heaters and general engineers. At present Design Engineer, design manufacturer and maintenance of variety of ground handling equipment for guided missiles. Interested in any position related to **MECHANICAL ENGINEERING ESPECIALLY WITH OIL OR MINING COMPANY AND PREPARED TO UNDERGO TRAINING.** Abroad—any country considered. £1,300/£1,400 p.a. approximately.

Ref. A.884. British. Female. S. African. Single. Age 26. **RESIDENT U.K.** B.Sc. Maths and Chem. 2 years Tracer/Mapping, city council. 3 years Head Tracer, engineering company. 1 year Draughtswoman/Tracer, assisting project engineer, heating, ventilation and mechanical engineering company. Experience of technical illustration. Seeks **DRAUGHTING/TRACING OR TECHNICAL ILLUSTRATION POST.** Central, W. or S. London. £14 per week.

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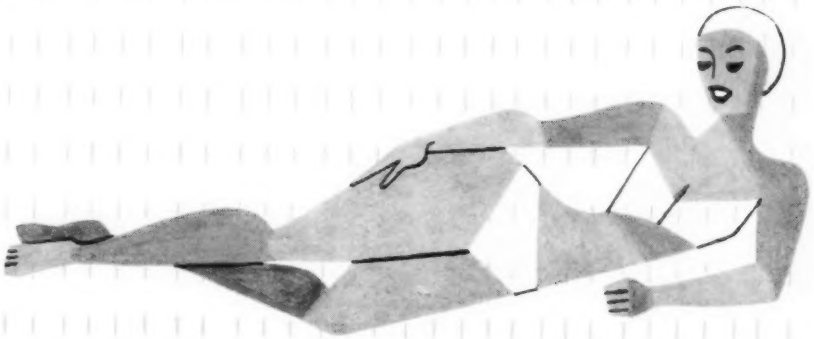

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